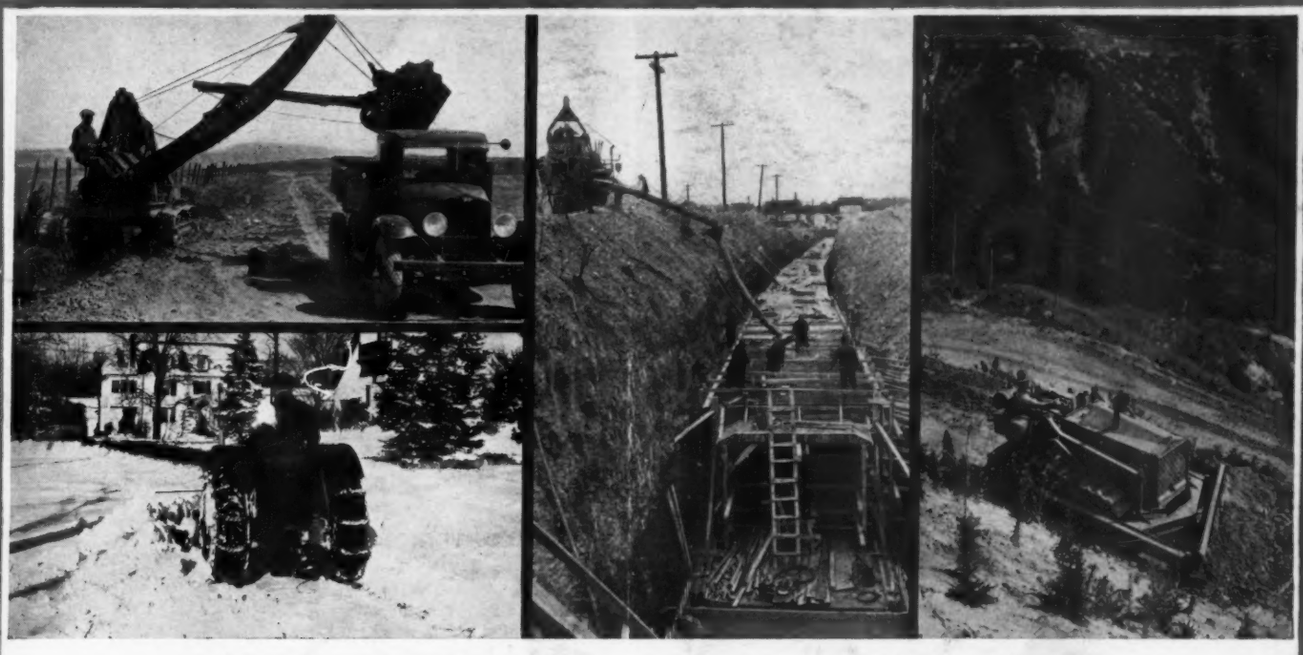
PUBLIC WORKS

City, County and State



Public works construction, north or south, east or west, adds to comfort and health protection and gives useful employment.

In this Issue:

OCTOBER, 1935

VOL. 66. PUBLIC WORKS No. 10

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OCTOBER, 1935

October 1935

PUBLIC WORKS

Vol. 66
No. 10

CITY, COUNTY AND STATE ENGINEERING AND CONSTRUCTION

TABLE OF CONTENTS FOR OCTOBER, 1935

TIMEWASTERS:

The Relief Workers:

What happened to the relief workers mentioned in this column has been of much interest to many of our readers. Well the engineer had quite an army to start with—something over 3,000—to be exact, 3121. From here on its easy.

Cork and Coal:

This was easy, too. Without looking it up or working through it we judge that the answer ought to be about 6 tons of cork and 30 tons of coal. Do our readers check on this?

The Chain Gang:

Another easy one. Take one of the six pieces of chain, which like the others, is 4 links long, and cut these four links apart. Use them to join the other five pieces. Therefore it is necessary to cut only four links to make the complete chain.

Ikey and Mikey:

This choice pair went hunting. Mikey's battleaxe had packed a nice lunch for him; Ikey's didn't do so well. If Mikey gave Ikey a sandwich, Ikey would have as many as Mikey and if Ikey gave Mikey one of his sandwiches, Mikey would have twice as many as Ikey. How many did they have to start with?

Page Mr. Ford:

A rectangular sheet of tin 15 inches long and 8 inches wide has a square cut out of each corner. Find the size of this square so that the sheet can be bent into a box of maximum capacity. Contributed by *R. N. Clark,* who had better send the solution, too.

Tchk! Tchk!

If the unit of angular measure is a degree or a radian, then only one angle, namely 0 degrees equals 0 radians, is numerically its own sine. If, however, the unit is a right angle, then three angles, —1, 0 and 1, are numerically their own sines. Find the unit for which exactly five angles are numerically their own sines. This was contributed by *John Bevan.* The Timewaster editor gives up on it; he's not even sure he has it written down correctly. However, our readers have never yet gone back on us. Does anyone here know—no, not Kelly, but how to do it? W. A. H.

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A. PRESCOTT FOLWELL, *Editor* W. A. HARDENBERGH, *Asso. Editor*

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When you need special information—consult the *classified* READERS' SERVICE DEPT., pages 51-53

PUBLIC WORKS

City, County and State Engineering and Construction

Vol. 66 *October, 1935* No. 10

Equipment Used in Water Purification

The first of a series of articles on the subject which will appear in* PUBLIC WORKS *during the next few months.

"The post-war period has led to a continuance of careful study of many items related to basic design data and to refinements in procedures for satisfactory operations. A list of items of more particular importance includes the following:

"1. Mechanical appliances for the continuous removal of silt and heavy sediment in basins, replacing the older intermittent cleaning operations.

"2. Mechanical appliances for prompt and more complete floculation of the water, prior to settling for filters.

"3. More complete preliminary clarification of water prior to filtration." Geo. W. Fuller in "Progress in Water Purification," Journal of Am. W. W. Ass'n for November, 1933.

SUSPENDED matters are generally removed from water by either sedimentation or filtering—frequently both. Centrifuges have been suggested, but apparently can not compete on a cost basis.

The suspended matters removed may be those already in suspension in the raw water, those caused by rendering insoluble matters originally in solution (ex., iron removal by oxidation), or those added to the water (as in the softening process). Very fine matter, colloids and bacteria may be rendered more readily removable by coagulation.

Where the amount of suspended matter to be removed is great and a large part of it is "settleable," sedimentation is cheaper than filtration. Where the amount is small, or so finely divided as to settle very slowly and therefore require large settling basins, filtration may be less expensive. In fact, for some matters removal by sedimentation is impracticable or even impossible.

Sedimentation is secured by passing the water slowly through a basin. The rate of flow desired should not be exceeded at any part of the basin; too great a rate may even take again into suspension matter which has already settled. To secure this condition, the rate should be uniform throughout the basin, or else unnecessarily slow throughout a considerable part of it, the latter involving increased basin size.

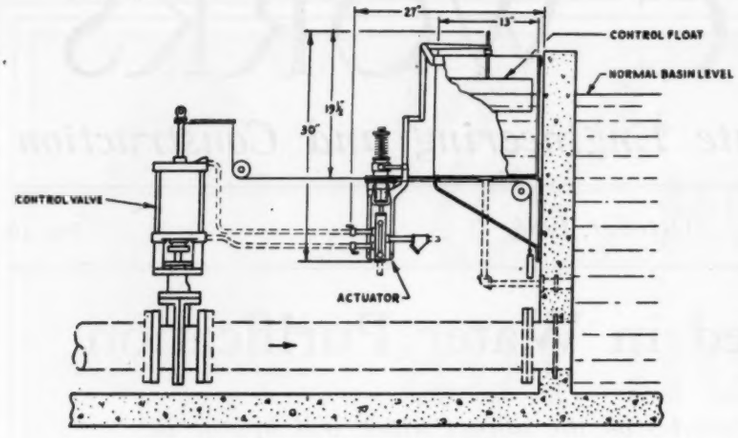
Having calculated the basin dimensions desired for a given rate of flow and built the basins accordingly, this rate should not be exceeded nor should the effective dimensions of the basin be changed. The former is secured by regulating the rate at which water enters and is drawn from the basin. Depth of basin is reduced by accumulation of sludge on the bottom. Basins receiving muddy river water have been so operated as to be filled to half or more of their depth with sludge before being cleaned; whereby their effective capacity is reduced 50 percent or more. If the resulting depth is sufficient, then the cost of the excess depth could have been saved if arrangements had been made to remove sludge continuously.

As a financial proposition, the question involved in this matter of sludge accumulation is solved by comparing the cost of a deep tank together with the capitalized cost of removal at intervals, on the one hand, with the cost of a shallower tank plus that of equipment for continous removal and the capitalized cost of operating such equipment; with allowance, in the former case, of an additional basin which can be put into service while a full one is being cleaned. This last is not necessary if the turbidity of the raw water is intermittent so that sedimentation becomes unnecessary at sufficiently frequent intervals to permit cleaning. Even then, however, the extra depth must be provided and may be more expensive than provision for continuous removal.

Continuous removal has the additional advantage, when the water carries organic matter, that, if such matter remains in a tank as sludge for several days, it will putrefy and tend to pollute the water passing through the tank and to make the sludge offensive when removed.

Sludge Removal Equipment

Continuous removal is obtained by use of machinery. (The word "continuous" is used for convenience; really, the removal may be intermittent—say twice a day or even once in two or three days, depending on the rate of accummulation of sludge). The machinery used for this purpose is of two general types, in one of which the mechanism revolves very slowly about a central shaft, carrying over the floor blades or scrapers set at an angle which works the sludge slowly toward a central well, from which it is drawn off by gravity or pumped; in the other, the scrapers are drawn in a straight line through the tank by endless chains. The former type generally operates in round or square tanks, the latter in rectangular ones of any desired width and length. In each



"International" basin level controller

type the motion is so slow as to be barely discernible, thus avoiding the creation of eddies in the liquid or the resuspension of the sludge.

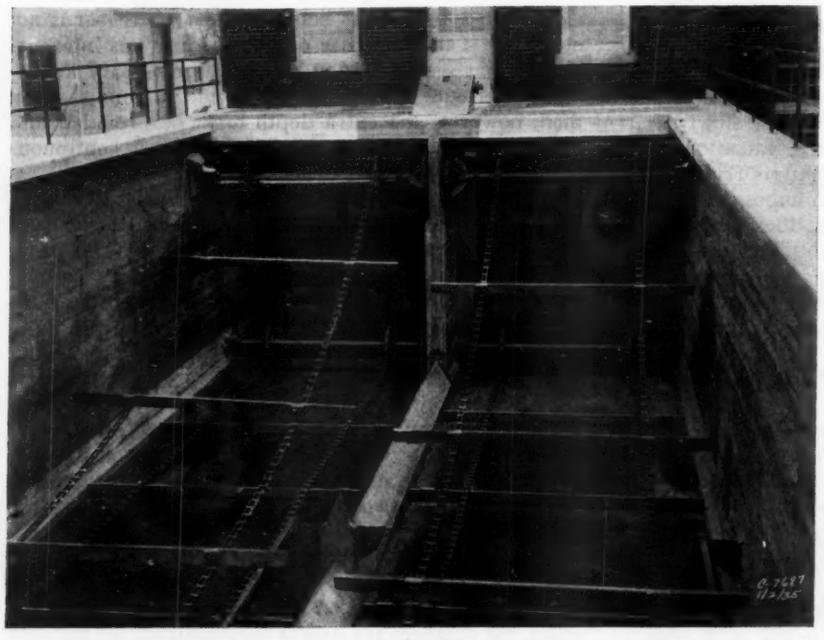
The power is generally an electric motor which, in the former type, is supported, together with the revolving equipment, by either a central pier or a truss which spans the tank; in the so-called tractor type the motor operates a small tractor which travels on a track surrounding the tank and draws the collecting mechanism with it. Square tanks can be used. a supplementary arm and its scraper blades sliding radially out to the corners and then back toward the center so as to follow the perimeter continously as it revolves. Or a square tank can be used without the supplementary arm by sloping the bottom steeply at the corners so that the sludge will slide down within reach of the raking arms. Collectors of the rotary type are made by the Dorr Co. and the Hardinge Co.

The other type consists of two endless chains, each moving close to one of the side walls of the tank, which carry scrapers or flights which extend entirely across the tank and are drawn by the chains along the bottom the entire length of the tank, pushing the sludge into an end hopper, and pass around vertical sprockets at each end. In this type the motor is installed at one end of the tank. Collectors of this type are made by the Link-Belt Co., Chain Belt Co., and Jeffrey Manufacturing Co.

Other designs of collectors are used similarly in removing sewage sludge but have not, so far as we know, yet been used for water purification although there seems to be no reason why they should not be. These include the use of two spiral scrapers instead of a number of short blades in the rotary type, made by the Hardinge Co., Simplex Ejector and Aerator Corp. and Row Engineers; a single blade the width of the tank carried by a traveller which runs on rails laid on the tops of the tank walls, made by the Link-Belt Co. and the Hardinge Co.; and the "circuline" collector, in which a bridge which revolves around a central tower in a circular tank carries a small collector of the second type which pushes the sludge to a central well, made by the Link-Belt Co.

Mechanical collectors of the types mentioned are in use in the water work plants of Mahoning Valley, Marysville, Massillon and Reading, Ohio; Decatur and Princeton, Ill.; Grand Rapids and Saginaw, Mich.; So. Pittsburgh, Pa.; Coffeyville and Neodesha, Kans.; Oscaloosa, Ia.; Kansas City and St. Louis, Mo.; Waupun, Wis.; Brownsville, Texas; Great Falls, Mont., and Sacramento, Calif., and several other cities. About a fourth of these are for plain, preliminary sedimentation, and three-fourths are used in connection with water softening.

In a few cases where the sedimentation basins are large and sludge collects in considerable quantities, dredges on boats have been used for removing sludge without drawing off the water.



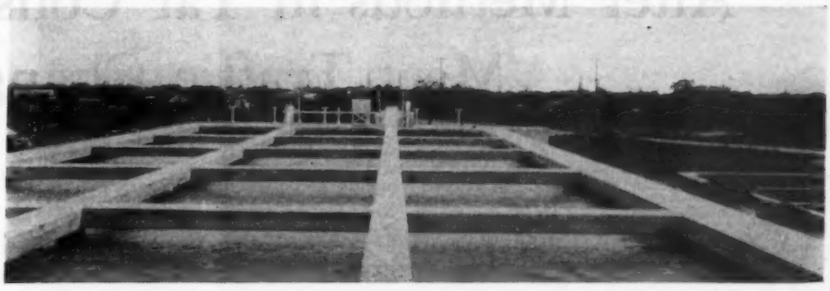
Chain Belt sludge collectors at Waupun, Wis., water purification plant

Removing sludge after drawing off the water is effected in some cases by flushing it out through a clean-out pipe, in others by removing the solid sludge by means of dragline, derrick, wagons or trucks moving on a temporary ramp, etc. For bringing it to a point convenient for loading into bucket or truck, horse-drawn or motor scrapers, bulldozers, etc., are used.

The same are sometimes used for bringing sludge to a point near the clean-out pipe for flushing out; but more commonly the hose is used for both purposes. A large amount of flushing water is needed for transporting the sludge unless there is considerable slope of the floor toward the clean-out opening, as well as for breaking down the banks of compacted sludge, which in some cases are 10 or 15 feet high. (In estimating the cost of sludge removal, the cost of this water should be included.) The

hose used for this purpose should be not smaller than fire hose, and large-size nozzles are desirable, since volume of water is more important than velocity except where the sludge is very solidly packed.

For withdrawing the water above the sludge preparatory to removing the latter, a multi-port outlet tower is convenient. In Cincinnati, water is drawn from the surface through float tubes, the bottom of which revolves about the outlet pipe as the water falls, the floats holding the open top continuously just beneath the surface. For a small reservoir, a similar method can be used by fastening one end of a large rubber hose (fire hose, if none larger is available) to the outlet and the other end to a barrel or other float so that the open end is about a foot below the surface.



Primary settling tank at Bronsville, Tex., using three Link-Belt collectors in parallel in one tank 42¼ by 100 ft.

Where there is much grit in the sludge it may be valuable as a sand substitute and be removed by hand before flushing out the finer sludge. Some plants (ex. New Orleans) have grit basins, the flow through which is at a rate permitting grit but not clay to settle.

Disposal of the sludge may or may not offer difficulties. In many cases it can be returned to the river from which the water was taken, which often is adjacent to the basin. In others it can be turned onto low land to drain out. Sludge from softening plants, however, is generally great in amount and disposal of it in either of these ways may be objectionable. Drying and use for land conditioning, burning and pulverizing, and re-use for softening are some of the proposed solutions. Grand Rapids has considered the use of vacuum filters for drying.

Optimum sedimentation conditions include a continuous uniform rate of flow through the basin. It may be necessary at times to vary the rate of withdrawal of water, and when this occurs the inflow should be varied correspondingly; otherwise there may be set up a surging back and forth in the basin that will stir up the sediment in it. This can be effected by electric connection between the valve controlling the basin discharge, and the valve or sluice gate controlling the inlet or the low-lift pump which supplies the water to the basin. (Distance control will be discussed in a later chapter.) Or a basin level controller can be used, which holds the level of water in the basin approximately uniform, regardless of the outflow. In such a controller furnished by the International Filter Co., a valve in the inlet line is raised or lowered by hydraulic power applied through the operation of an actuator, which in turn is regulated by a float if near the basin, or by pressure exerted through an orifice in the tank and a connecting orifice pipe, if distant from the basin.

Colloidal matter, bacteria and very fine suspended matter can not be removed practicably by sedimentation alone, but if they can be agglomerated into large particles, combined if necessary with other heavier matter, it may be possible to so remove them. Coagulation without weighting is commonly employed preparatory to filtering, in which case the coagulant is applied near the outlet of the settling basin. Methods of applying coagulant will be discussed in connection with filtration.

Whatever kind of coagulant is used, it should be applied in calculated and measured doses, should be thoroughly mixed with the water, and generally be given combinations.

Algae growths in basins are generally prevented or destroyed by use of copper sulphate. This is distributed by placing sulphate crystals in burlap bags and towing these from the stern of a rowboat or motor launch; or copper sulphate solution is sometimes sprayed from the boat by means of a spray pump—such as is used for spraying trees. Louisville, Ky., has reduced algae growths by adding turbidity to the clear raw water. Softening as well as clarification have been accomplished by treatment with lime and sodium aluminate followed by sedimentation alone. Equipment for applying chemicals will be described later.

One of four Dorr 200-foot clarifiers at Kansas City Sedimentation of 100 m.g.d. of turbid water

Alter Methods in Tar Construction to Meet Traffic Changes

By A. R. Taylor

Engineer, Tarmac Department, Koppers Products Company

WITHIN the past few years there has been considerable change in automobile traffic. Speeds have increased, tires have been redesigned for lower pressures and greater traction, and trucks have been equipped with pneumatic rather than solid tires. These changes have naturally altered the effect of traffic on road surfaces. No longer is the ruinous effect of impact from solid-tire truck traffic (and its tendency to compact and wave any but very stable surfaces) a serious factor. On the other hand, wider treads and lower tire pressures, together with higher speeds for all classes of automobile traffic, from ordinary cars to buses and trucks, creates considerably greater suction on the road surface, so that the aggregate must be thoroughly embedded in the road surface if it is not to be torn loose and whipped off the road.

The demand for safe, skid-resistant all-weather surfaces has resulted in the construction of open surfaces. Large and uniform sized cover material has been used in surface treatment work, and mixed-in-place and drag treatments have been improperly choked and sealed.

Experimental work as recently reported shows that roads built with a sandpaper finish are skid-resistant, and that open, toothy surfaces are not necessary for safe, all-weather roads. Open surfaces weather rapidly, require more maintenance, and also penalize the motorist by causing considerably greater tire wear than do tight surfaces. Their construction should be discontinued. Unfortunately, open surfaces have been built at the very time when changed traffic conditions make it desirable to construct dense, tight road surfaces.

Changed traffic conditions are easily met in low-cost road construction. Heavier or more viscous grades of tar, more care in the selection of the size and amount of cover material, and in properly choking and sealing mixed-in-place and drag treatments, will result in tight finished surfaces.

Use of Heavier Grades of Tar

In the construction of tar roads it is advisable to use the heaviest grade of tar best suited to the method of construction. This holds true from prime coat work to the heavier types of construction. The proposed standard grades of tar recommended are as follows:

Grade Designation			*CONSISTENCY*			
Tarmac	*Standard*	*USED FOR*	*Application Temperature*	*Specific Viscosity* 50 cc @ 40° C	50 cc @ 50°	*Float Test, Seconds* @ 32° C	@ 50° C
P-1	TC-1	Prime coat	60-150°	8-13			
P-2	2	Prime coat	60-150°	13-18			
P-3	3	Cold surface treatment and prime coat	80-150°	18-25			
P-4	4	Cold surface treatment and prime coat	80-150°	25-35			
P-5	TM-1	Retreatment and mixed-in-place construction	80-150°		18-22		
P-6	2	Retreatment and mixed-in-place construction	80-150°		26-36		
A-1	TH-1	Hot surface treatment	170-225°			60-150°	
A-2	2	Seal coat, mixed-in-place construction	170-225°			150-210°	
T-1	TP-1	Hot patch, crack filler, penetration construction	200-250°				100-160°
T-2	2	Penetration construction	200-250°				160-220°
CP-1	TCP-1	Cold patch	60-100°	35-60			
CP-2	2	Cold patch	60-100°	60-80			

Close-up of an open mixed-in-place surface. A seal coat should be added to close the surface and increase the life of the pavement

Tight, well-sealed tar surface, showing skid-resistant properties retained four years after sealing

Prime Coat. In the past a light grade of tar, TC-1, was nearly always used for prime coat work, regardless of whether the surface to be treated was tight, open or porous. Light grades on open surfaces penetrate to a greater depth than necessary. By the use of heavier grades of tar the depth of penetration may be regu-

lated. Light grades should be used on dense, tight surfaces, and heavy grades on open or porous surfaces. Road and atmospheric temperatures play an important part in the depth of penetration. During hot weather heavier grades of prime should be used than in the fall and spring.

For priming very open surfaces such as Pennsylvania's hand-knapped stone bases, heavy grades of tar, TM-1 and 2, have been used to advantage during the summer months. Even for tight surfaces, such as gravel, top soil and sand clay, TC-2 and 3 grades are more satisfactory in hot weather than is TC-1.

Mixing hot tar with aggregate during summer months without difficulty

Surface Treatment. For surface treating top soil, gravel and similar type roads, the grades of tar selected should be adapted to the type and condition of the surface of the road to be treated.

Light broom drag used to distribute cover material evenly

For single treatments, the tar should be of such consistency that it will penetrate the road surface and at the same time hold sufficient cover material to build an adequate wearing surface. Ordinarily TC-3 or 4 is best suited for this type of treatment.

On double applications, the tar for the first application should be selected primarily for its penetrating characteristics, taking into consideration the surface to be primed; whereas for the second application the grade of tar should be selected for its binding and sealing characteristics. Ordinarily TC-2 or 3 is preferred for the prime coat, and TH-1 and 2 for the second application, although TM-2 is often used for the latter purpose.

When a seal coat is added, TM-2 should be used.

Mixed-in-Place Construction

Mixed-in-place construction is of two types, the mulch treatment or graded aggregate type, and the coarse aggregate type.

The mulch treatment consists of a mixture of tar and aggregate, graded from 1¼" down. The grade of tar to use depends on the time of year the work is being done, the per cent of fine aggregate passing the No. 200 mesh sieve, and the method of mixing, whether road or plant mix.

For summer use, TM-2 should be used in the road mix when the per cent of fines passing the No. 200 sieve is less than 5%. When over 5% of No. 200 mesh material is present, TM-1 or 2 should be used. The next heavier grade of tar should be used for plant mixes. In cool weather, lighter grades of tar should be used.

The coarse aggregate type of mixed-in-place construction consists of tar and ½" to 1½" crushed aggregate. For this type of aggregate, either TM-2 or TH-1 may be used for the road mix in the summer months, dropping to the next lighter grade in the fall and spring. TH-1 or 2 should be used for plant mixes.

For sealing both types of mix, best results are obtained by using TH grades, although TM tar may be used. The coarse aggregate type should be given a choke seal and final seal coat, whereas the mulch treatment only requires one seal coat.

Retreatments

Retreatments are applied primarily either to seal the road surface, to build up the wearing surface, to improve the smooth riding qualities of the old surface, or to make slippery surfaces skid-resistant.

For these classes of work either TM-2 or TH tar may be used. TM-2 is preferred for sealing tight or dry surfaces, and TH for sealing open surfaces, or where it is desired to build up the wearing surface. Drag treatments are used for smoothing up old surfaces.

Aggregate Size and Characteristics

Much trouble has been caused by using an excess of cover material, or by the use of improperly sized and poorly graded aggregate, particularly for seal coats, retreatments and surface treatment work.

Excess cover material tends to kick off the road surface, and in doing so the loose aggregate grinds against the bituminous bound aggregate, thus causing excessive wear on the surface aggregate. This grinding action makes considerable dust, which blots up the bituminous material and prevents it from holding a normal amount of cover material, thus having a tendency to reduce the normal life of the treatment.

When using porous aggregate, it is particularly important to see that the amount of cover material is reduced for a given quantity of tar, as otherwise there is sure to be an excess amount used. Harmful results are obtained from excess cover material, whereas little trouble is experienced when the cover is applied a trifle light. Additional cover can be applied much more easily and cheaply than can excess cover be removed.

Large sized and poorly graded aggregate has been used to obtain skid-resistant surfaces. When of uniform size, with few intermediates, very open surfaces are obtained. Weathering and the sucking or tearing-out action of high-speed traffic takes place, and before long the cover material is kicking to the edges of the road. Well graded aggregate helps eliminate this condition, as the intermediate sizes tend to fill the voids of the large sizes, giving tight, well-sealed stable surfaces, more impervious to the action of weather and traffic.

Open or porous road surfaces naturally require heavier applications of tar than do tight surfaces, as the tar penetrates into the old pavement, leaving less on the road surface to bind the cover material.

As a rule, the hot tars, TH grades, hold a greater amount of cover material than do the TM grades. Being of heavier consistency than the TM grades, they may be covered with larger sized cover material to give surfaces with greater initial stability.

When using ¼ to 1/3 of a gallon of TM-2, approximately 15-25 lbs. of well-graded aggregate ranging in size from a No. 8 to ⅜" square-opening sieve, or a good grade of coarse sharp sand should be used; whereas slightly larger aggregates, graded from No. 8 to ¾" square-opening sieve, gives better results with the TH grades, using about 10 lbs. per square yard for each one-tenth of a gallon of tar.

In mixed-in-place construction, close attention should be given to the size and amount of aggregate used for the choke and seal coat, as the success of this pavement largely depends upon properly choking and sealing the surface. For choking the mix, 10-15 lbs. of No. 8 to ⅜" aggregate should be used, and approximately the same amount and sized aggregate for covering the choke seal and final seal coat. This type of pavement requires a total of 30-40 lbs. of fine aggregate to properly choke and seal the surface.

The mulch treatment or graded aggregate type gives best service when given a light seal coat, covered with well-graded, small sized aggregate. Coarse sharp sand may be used, but better wearing qualities are obtained by using larger aggregate, such as No. 8 to ⅜" size.

Drag Leveling Course

Unfortunately, indiscriminate dragging with long base drags has become common practice for seal coat and retreatment work, with the result that more harm than good has been done. Dragging light treatments, in which 15 lbs. to 30 lbs. of cover material is used, does little towards smoothing the road surface, as this quantity of cover material is insufficient to level up a rough surface. If it is simply desired to distribute the cover material evenly, light broom drags are just as effective, and do not mix the aggregate and tar. Mixing with long base drags tends to break the film of bituminous material on the road surface, so that sealing action of the treatment is destroyed.

The old method of retreatment and seal coat work is a better method of obtaining tight surfaces. Here the tar is first applied to the road and covered with the proper size and amount of aggregate, after which it is either rolled or traffic is permitted to iron out the treatment.

When it is desired to smooth up a rough surface, heavier treatments are required. For such purposes the drag leveling course should be used. Usually a minimum of 60 lbs. of aggregate is necessary to smooth a rough surface. A well graded aggregate ranging in size from No. 8 to ¾" should be used. After mixing and leveling with long base drags, the surface is rolled. Unfortunately, at this point many drag leveling courses have been considered finished due to the knobby smooth-riding surface obtained.

The surface, however, is not finished without a seal coat, and the importance of the seal coat cannot be overemphasized. A tight surface must be obtained if the treatment is to give maximum service. The seal coat consists of 0.2 to 0.3 of a gallon of tar covered with 10 lbs. to 20 lbs. of small chips, such as No. 8 to ⅜" size; or a coarse, sharp sand.

In drag treatments there has also been a tendency to use too large an aggregate. Oftentimes the maximum sized aggregate has been larger than is the compacted depth of the surface. It is obvious that the maximum size of aggregate should be less than the compacted depth of the surface constructed.

Summary

The above procedures do not increase the cost in the construction of low-cost roads, yet their adoption will eliminate many of the troubles encountered in the past two or three years due to changed traffic conditions and the tendency to build open surfaces for their skid-resistant qualities.

In summing up, careful attention should be paid to the following construction procedures:

1. Use the heaviest grade of tar suitable to the method of construction, from prime coat work to mixed surfaces.
2. Select the proper quantity and grade of tar—depending upon the type of surface to be treated.
3. Select the size, gradation and amount of aggregate, according to the depth and type of surface being constructed.
4. Construct tight surfaces by properly choking and sealing. Tight surfaces properly constructed with tar are skid-resistant.
5. Eliminate the use of long base drags for the final application of tar and cover material. If desired, light broom drags may be used to distribute the cover material evenly, although even this procedure is unnecessary.
6. Make sure the finished surface is tight and properly sealed.

Nebraska County Adopts Creosote Wood Bridge Standard

After careful study of the conditions affecting the construction, use and maintenance of the bridges on its rural road system, Hall County, Nebraska, recently adopted a 19-ft. span treated timber bridge design. In addition to the drainage structures on the county roads, the engineer of this county also has jurisdiction over all bridges of more than 12-ft. span on the township roads. Structures totaling 2.6 miles in length were recently built according to this design over the Platte River and its tributaries.

The standard timber bridge has a 20-ft. roadway and is supported by 4-pile bents capped with a 24-ft. timber to permit future widening of the roadway without alteration of the sub-structure. Thirteen rows of 4 x 16-in. x 20-ft. stringers are placed for each span, the outer stringers being butted and spliced. Strap irons tie the super-structure down on the caps. The floor is composed of 2 x 4-in. laminated strips, with a sand-clay surface of selected materials, this being the usual county road surfacing. The bridge surface retainers are 4 x 4-in. pieces, bolted through the floor. The outside stringers are set 4 in. back under the floor to give the hand-rail posts side support from the floor in addition to the customary bolting to the stringers and caps. The backing and wings are 3 x 12-in. plank.

Care is taken to protect all unavoidable field cuts. All bolt holes are creosoted with a Greenlee pressure bolt hole treater. The ends of pieces cut off are immersed in a barrel of hot creosote for several hours. The pile cut-offs are given coats of hot creosote and a waterproof covering.

The treated wood in these bridges is Douglas fir given a final retention of 8 lbs. of coal-tar creosote per cubic foot by an empty-cell process.

L. H. Rudd is county engineer of Hall County, with headquarters at Grand Island, Nebraska. The above description is from *Wood Preserving News*.

Chemical-Mechanical Treatment of Sewage

By Philip B. Streander* and Michael J. Blew†

IV—*Mechanical Filtration. Sludge Treatment*

Advantages of Filtration Flocculation followed by precipitation or settling removes the major portion of suspended and colloidal solids present in the sewage, but only with comparatively long detention periods and high chemical costs. Both the settling tank volume and the costs of coagulating chemicals can be reduced by the use of filter beds following precipitation. Filter beds should therefore form an integral part of all chemical treatment plants. Not only are the settling tank volume and costs of chemicals reduced, but the quality of the final effluent is materially improved by filtration. All of the non-settling "pin point" floc can be removed by filter beds and in addition they will also remove a portion of the sewage solids which cannot be otherwise removed. With properly designed and operated filter beds the effluent has a clear, sparkling appearance and contains practically no suspended solids.

Types of Filters Filters available for the filtration of chemically treated sewage are those of the fixed filtering medium, represented by the mechanically cleaned downward and upward flow type, and the flexible filtering medium class represented by the rotary or vacuum type filters. The filtering media used are varied depending largely upon the type of filter bed used. With the upward flow type of bed, using a so-called "magnetite sand" (crushed iron ore) as the filter medium and a mechanical cleaner, the bed is usually constructed inside of a circular tank and as an integral part of the settling compartment, as shown in Figure No. 7. With the downward flow type of bed, using either silica sand or anthrafilt (fine coal) as the filter medium and a mechanical cleaner, the bed can be constructed outside of a circular settling tank and built integrally therewith, as shown in Figure No. 8, in which instance the functions of settling and filtration are entirely separated. The filter beds can also be constructed separately and entirely distinct from the settling tanks, using either upward or downward flow type with mechanical cleaners, as shown in Figure No. 9. With such a separation it might often be advantageous to construct these as an integral part of the contact tank, thereby filtering sterilized sewage.

Factors Influencing Rates of Filtration The rate of filtration to be used is influenced by the characteristics of the filtering medium, the thickness of the bed, the loss of head, the reduction of solids to be effected, etc. A filter medium fine enough to give a clear effluent will cause a low rate of flow and an increase in the pressure or loss of head will tend to force the solids into the medium, plugging it and requiring frequent washing. A coarse filter medium will not retain the finely divided "pin-point" floc and therefore is not as efficient as the fine filter medium. A coarse filtering medium, if preceded by efficient coagulation with the formation of large floc and settling, will give fairly good results, but at the expense of increased chemical costs. The proper combination undoubtedly is that wherein flocculation can be obtained with small doses of inexpensive coagulating chemicals and the use of a filtering medium of such fineness as to remove the major portion of the finely divided matter.

Rates of Filtration Rates of filtration now used and advocated are undoubtedly an outgrowth of water works practice which has been more or less standardized at 2 gallons per minute per square foot of filter area. Such rates may or may not be applicable to sewage filtration as the treatment conditions and the requirements thereof are entirely different. Until more complete data are available giving the efficiency of removal, the loss of head, the percentage of wash-water and power used in cleaning, etc., rates of filtration should not exceed 4 gallons per minute per square foot of filter area, which corresponds roughly to a rate of 2 gallons per minute for average daily rates of flow.

*Of Watson and Streander, New York, N. Y.
†Research Engineer, Philadelphia, Pa.

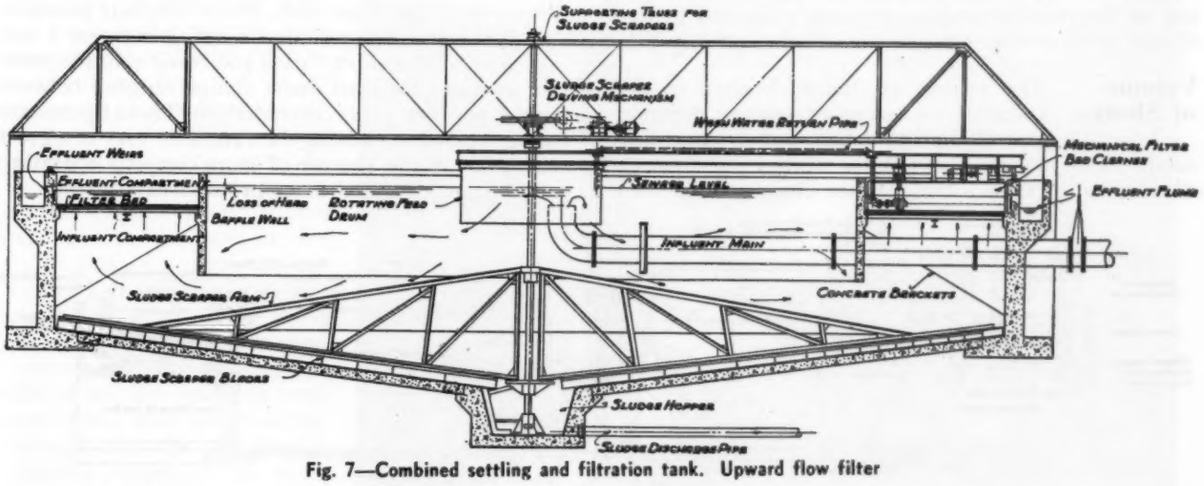


Fig. 7—Combined settling and filtration tank. Upward flow filter

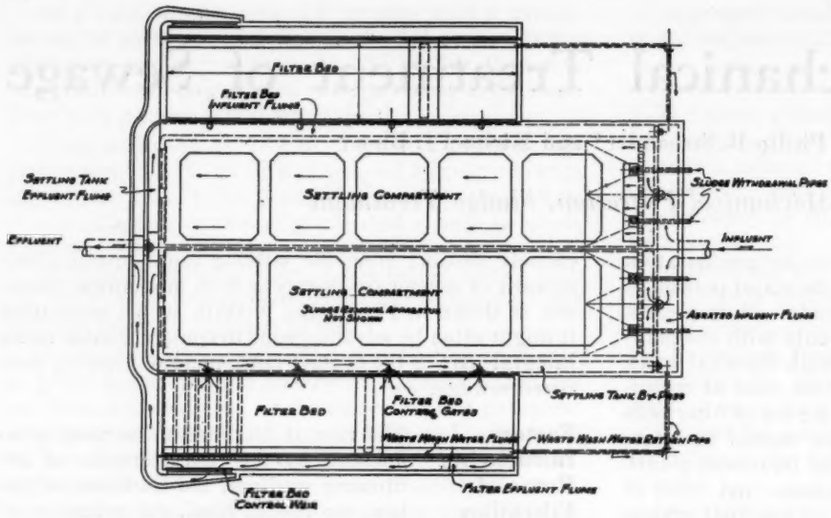


Fig. 9—Combined rectangular settling and filtration tank. Mechanical washer

Properly designed and operated filter beds should effect a removal of not less than 90 per cent of the suspended solids contained in the sewage entering the filter. Waste wash-water should preferably be returned to and mixed with the entering raw sewage or can be returned to the influent end of the settling tank.

Sludge Treatment and Disposal

General Definitions By sludge treatment is meant the addition of supplementary coagulants to the sludge to aid in the separation of the solids from the liquid and by disposal is meant the ultimate disposition of the sludge by dumping or by incineration. The liquid portion of the sludge has in the past been referred to as the moisture content, i.e. 90 per cent moisture meaning 90 per cent liquid and 10 per cent solids, 96 per cent moisture meaning 96 per cent liquid and 4 per cent solids. A much easier method is to reverse this and state the solids concentration of the sludge, wherein 10 per cent concentration would refer to 10 per cent solids and 90 per cent liquid, 4 per cent concentration would mean 4 per cent solids and 96 per cent liquid, etc. Such a method is easier to use and gives an accurate determination of the relative volume of sludge. For example, a sludge having a concentration of 5 per cent dewatered to a concentration of 20 per cent would have one-quarter of its original weight, the concentration figures having a direct bearing on the relative amount of solids contained in the sludge in its various phases of treatment and disposal.

Volume of Sludge The volume of sludge obtained in the chemical treatment of sewage depends entirely on (1) the amount of suspended solids in the raw sewage, (2) the efficiency secured in the removal of these solids, (3) the kinds and amounts of coagulating chemicals used and (4) the solids concentration of the sludge. The amount of suspended solids (1) in raw sewage varies to a great extent between various municipalities. With the same sewage it varies largely by the hour of the day, the day of the week and the season of the year. Composite sampling over a comparatively long period of time must be done to secure any accurate determination of the suspended solids in the sewage. The efficiency secured in the removal of suspended solids (2) depends largely on the design and operation of the plant. With efficient flocculation, settling and filtration, chemical treatment should result in the removal of not less than 90 per cent of the suspended solids. Having the amount of suspended solids in the sewage, the amount of solids removed (dry basis) can be readily computed. The amount of solids produced is further influenced by the kind and amounts of coagulating chemicals used. With a sewage containing an appreciable amount of the carbonates of calcium and magnesium the addition of lime may not be necessary or the amount added may be quite small. In such an instance the volume of solids produced (dry basis) will be increased by an average of about 10 per cent. Using lime and a ferric or ferrous salt results in the production of between 20 and 40 per cent more solids than computed by the removal of the suspended solids. This is further influenced by the character of the water, a hard water generally producing more sludge than a relatively soft one.

Concentration of Sludge The actual volume of sludge depends also on the solids concentration, this varying between 2 and 6 per cent as removed from the settling tanks. Factors influencing the solids concentration are the characteristics of the sewage solids, the kind of coagulating chemicals used and to a lesser extent the design of the settling tank. A ferrous salt such as copperas converted to ferric hydroxide by the addition of chlorine or by calcium oxide (lime) and artificial oxidation produces a sludge having a low solids concentration ranging between an average of 2 and 4 per cent. Ferric sulphate produces a slightly more dense sludge ranging between 3 and 5 per cent solids concentration and ferric chloride probably produces the most dense sludge ranging between 4 and 6 per cent solids concentration. These figures are averages based on existing data and may vary to a great extent, but in the absence of more complete operating data they may be used for approximations at least.

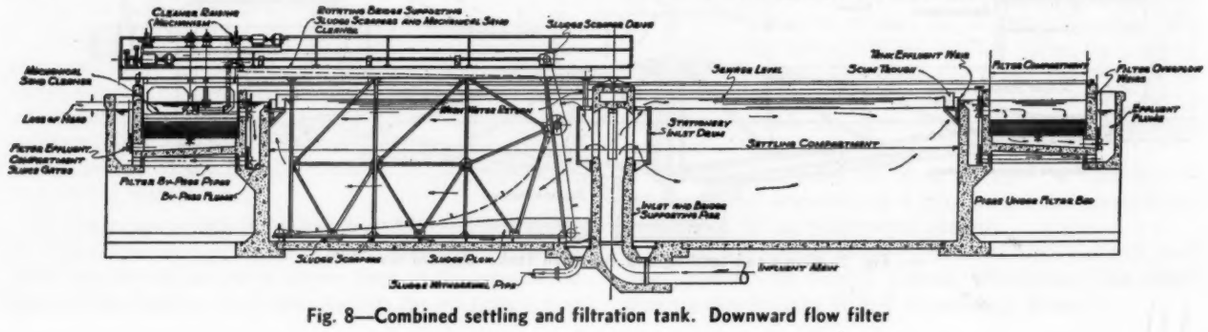


Fig. 8—Combined settling and filtration tank. Downward flow filter

Alan D. Drake

Rehabilitation of Buffalo Water System

By Alan D. Drake
Commissioner of Water, Buffalo, N. Y.

THE effective use of relief labor under the ERB and WPA for improvements of a permanent nature features a program of water main rehabilitation and extension in Buffalo, New York. From a small force in the early stages of the project, the number of men employed grew to six thousand at the peak of activity, and during the same period two hundred seventy-five workmen were developed into skilled caulkers by a thorough-going plan of supervision and training. As a result of this effort, water leakage has been reduced, troublesome lines have been put in good condition, lost valves have been located and restored to usefulness, hazardous conditions have been exposed and corrected, and needed improvements to the system have been made possible.

Initial impetus was given to the program by the dramatic crushing of a thirty-six inch main by a heavy truck loaded with brick which dropped through an unsupported section of pavement. Investigation showed that in the vicinity of the break the pipe joints were in bad condition, and that continued severe leakage had undermined the pavement. A large sewer carried off the escaping water and no external evidence of the true state of affairs appeared until the final rupture occurred. Three million dollars were allocated to the Water Department, and gangs organized under the ERB to uncover joints, make necessary repairs, backfill, and repair the cuts. It was stipulated that all work was to be done by hand, and this policy has been maintained throughout, even to hand mixing of concrete for repaving cuts. It should be mentioned that no pavements have been cut on which paving guarantees are still effective, and for the most part the pavements have been down for over twenty-five years.

As a start, an office survey of trouble records was made to disclose the weakest points in the system, and on the basis of this study a rational progress plan was laid down and operations started. From the force available about twenty men were found who had the necessary experience and qualifications for caulkers and joiners. These were put in working charge of gangs, and during the earliest stages of the work were subjected to close supervision. To make possible a rapid expansion of effort, students, or apprentices, were selected on the basis of marked aptitude with tools, and assigned to different gangs for training. In addition to practical working experience on the gangs, the students were given a course of instruction in the shops to fit them for positions as gang bosses and as they qualified new gangs were organized and assigned to work. From a group of twenty at the start, the organization was built up to two hundred ten caulkers and eighty-five students.

The efficiency of workmen on this project was judged, by various standards and according to divergent opinion, to be about seventy-five per cent of that expected on a well managed contract job. This figure applies to the efforts of the force as a whole and not to the efficiency of the methods used.

The benefits from the work done have grown more and more apparent as the job progressed. To date, twenty thousand joints have been uncovered and the discovery made that seventy-five per cent of them have needed recaulking. On one section it was found that eighty-five per cent of the joints were in bad shape, in every case owing to lead being forced out of the joint. The pipe in question averaged about forty years in the ground, and in some instances sections have been in use for eighty years. Occasionally the pipe has been found to be in poor condition and about five thousand seven hundred feet, laid in 1869, has been abandoned and

Making a joint on the Kensington line with Dresser couplings, using relief labor.

Leak in old main repaired by recaulking.

relaid. It is difficult to estimate the quantity of water formerly lost through defective joints, Buffalo not being metered, but a study of the records seems to indicate a saving of about five million gallons per day. Furthermore, a number of buried valves have come to light, and others found with vaults and manholes in poor condition, so that in all, two hundred large-size valves have been discovered, repaired, vaulted and put into workable shape.

Excessive leakage frequently results in hazardous conditions, and many such have been found in Buffalo. In several instances cavities under heavy traffic pavements have been located and filled. In one place three lengths of a large main were found totally unsupported, the foundation having been washed out by leaking water, and at another spot, in sandy soil, two hundred feet of thirty-six-inch main was found to be supported by blocking alone, for the same reason. When it is considered that the major break already referred to resulted in one hundred thousand dollars of damage claims, a considerable economic advantage is at once apparent. Other hazardous locations have been exposed where mains are situated near building foundations and joint leaks have started to undermine the structures.

In addition to the program of water main rehabilitation, needed improvements are being carried out with the help of relief labor, including the conversion of a 116 million gallon reservoir into a stadium and recreational area, and construction of three new elevated steel tanks, with capacities of two million gallons each. With the completion of the elevated tanks, the entire city will be placed on high pressure service, eliminating the low pressure districts now supplied from the old reservoir. A contract was let on August thirtieth to the Chicago Bridge and Iron Company to fabricate and erect the three new tanks for $327,000. Foundations for the towers are being constructed now by relief labor. The tanks will require 1,050 feet of 24-inch pipe, and 5,900 feet of 36-inch pipe for proper connection to the system. Each tower will be equipped with a long-distance water stage recorder, registering at the central pumping station, the sub-contract for which has been let to Wallace and Tiernan.

Certain connecting links are being laid to improve pressure conditions and to provide emergency safeguards. It is planned to install 4,350 feet of 36-inch main in Bailey Avenue, and work is well along on 10,725 feet of 36-inch steel pipe line in the Kensington district.

The Kensington project is of particular interest, not only because of the nature of the excavation, but also because of the rapidity with which the pipe is being laid in the finished trench. For over two thousand feet the line runs across an old quarry floor, with an average trench depth of about six feet. All of the rock has been hand excavated, by drilling, feathering and wedging, barring, and finally sledging to one man size. The rock is dark, hard limestone, with seams varying from a few inches to a foot or more in thickness, and in general shows evidence of shattering from previous quarrying operations. The force at work varies up to about five hundred men, depending on the number available from other projects. The stone taken from the trench is broken to chips and to 3½-inch size, and the supply of Telford, chips, and number four stone is used for road work in other parts of the city. For a short distance there is an overburden of from one to three feet of soil, and in this section of about four hundred feet the trench is tight sheeted above the rock.

The pipe itself is thirty-six inch inside diameter, welded steel, with one-half inch walls, in forty-foot lengths, furnished by the American Locomotive Company from Dunkirk, New York. The spun bitumastic coating extends to the end of the pipe inside, and to within one foot of the end outside to leave space for Dresser Couplings. The pipe is lowered into the trench by a truck crane, the section being supported in web slings as a precaution against damage to the coating. The crew can assemble the couplings and make up joints about as fast as the truck can lower the pipe sections into the trench, so very little time is lost by any part of the laying gang. During the first eight-hour day the green crew, totally unfamiliar with this particular type of work, laid seventeen sections for a total length of six hundred eighty feet. Backfill material is brought in by truck, and placed by hand.

The above work is being done under the direction and supervision of the Water Department, cooperating with ERB Director Francis Downing, and Manager of Construction J. J. Hillary.

Compacting Embankments

Greater attention is now given in California to the compaction of embankments, the tendency being toward specifying the density of the embankment rather than the type and weight of equipment to be used. When density is specified, it is required that the amount of material after drying within a unit of space in the completed embankment shall be not less than 90 per cent of the amount of the material which would be compacted in a like unit in the laboratory under specified and controlled conditions. In the laboratory the material is dried, weighed, moistened, and consolidated in a cylindrical mold six inches in diameter and eight inches high under a load of 2000 pounds per square inch. In general, water used for compacting embankments is paid for as a separate item, and it may be applied either at the fill or at the cut, after the material is loosened.

Various methods are also being tried to avoid the erosion of wide embankment slopes, one of these being the insertion of level brush mattresses along the edges of the embankment at vertical intervals as the embankment is constructed.

The Editor's Page

Prepare Now for Handling Snow and Ice

As in previous years, we again call attention to the necessity of beginning at once preparing for winter's inclemencies—making plans and overhauling old equipment and ordering new. In this and the two succeeding issues we will tell how the work is done in a number of States, counties and cities.

Some Statistics on Post Roads

In an address before the 32nd Annual Convention of the National Rural Letter Carriers' Association, C. M. Upham of the American Road Builders' Association gave some interesting figures on the use of highways by letter carriers. He introduced his subject by telling of the applicant for a job, who said: "For 25 years I lived on the RFD, but three years ago I went on the RFC, and a year later on the CWA, and then on the PWA, and now I want to get on the WPA."

Each week day, 43,000 mail carriers use 1,250,000 miles of highway for delivering mail to 30,000,000 rural population. The average route traveled was 37.9 miles, of which 7.5 were hard surface, 12.0 miles were some improved type, and 18.4 miles were mud. Reports by 1,801 of the carriers named 1,530 unbridged streams, but mud was the greatest obstacle to travel, with snow, bad drainage and ruts being close runners-up. Bad roads made the use of horses necessary on 17,703 days, or an average of 32.2 days per carrier.

Stating that it costs 2 cents a mile more to travel on mud roads than on improved surfaces, Mr. Upham pointed out that the cost to the letter carriers because of bad roads was around $4,800,000 a year.

At any rate, his figures show that there still remains plenty of work for the highway engineer to do.

Motor Tourists Distribute Wealth

Judging from surveys made by Missouri's State Highway Department, the average motor tourist spends six days and $47.94 in each state he visits. States which have increased gasoline tax rates on the "soak-the-motorist" plan, hoping to catch particularly the visitor, will be surprised to learn that he contributes less than $1 to the treasury!

The surveys showed that the average tourist travels about 80 miles a day. About 24 per cent spend nights at hotels, 30 per cent at cabin camps, and 28 per cen at private homes. The survey showed also that motor tourist traffic brought nearly $31,000,000 into Missouri in the course of a year.

A survey of traffic on Florida State highways, conducted by the U. S. Bureau of Public Roads and the Florida State Road Department showed:

"Tourists using hotels and those staying at their own homes are estimated to spend the largest amounts. The expenditures of each of these groups are nearly $28,000,000 per year.

"On the average, each tourist car travels about 1,000 miles in Florida during the visit, or 515,000,000 for the total traffic. At 14 miles per gallon, 36,786,000 gallons of gasoline are consumed, yielding $2,875,000 at the current tax rate of seven cents per gallon, and equivalent to approximately 16 per cent of all State gasoline taxes."

Reducing Highway Accidents

The toll of highway accidents continues so heavy that everyone is interested in methods of reducing them. From the State of Washington comes a note that the State Highway Department has reduced accidents due to dust hazards by "approximately 50%" by means of a dust-laying truck. This truck carries an 850-gallon water tank with the contents of which it sprays the road; four tank loads of water being used daily by each truck, while the average daily mileage of truck travel is 146.

This calls attention to one of the less well-known profits resulting from good roads. It seems to us, however, that far more good would eventually result if this truck were employed in improving the road surfaces by distributing something of more lasting benefit than water. There are plenty of low-cost surfacing materials available, which will not only eliminate permanently the dust hazard, but also will give smoother travel facilities, and an all-year road. Wherever possible, efforts to improve highways should not be palliative only, but should look forward to a real degree of improvement. When properly planned and constructed, such highway improvements are an investment which continue to yield returns for many years.

Direct Labor vs. Materials in WPA Projects

The following was written by E. A. Kemmler, Director of Public Service of Akron, Ohio, as part of one of the monographs which that department publishes weekly. It so well expresses what so many public works engineers believe that we take the liberty of quoting it on our editorial page.

"The WPA has always stressed the necessity of submitting applications for projects with high percentage of *direct labor*, regardless of the class of material required. It is a safe bet that 99 out of 100 engineers would undertake to prove this policy as absolutely unsound, particularly in the case of sewers, pavements, bridges, buildings and kindred types of work, where the material itself is 75 to 90 per cent labor, the class of labor that makes the wheels of industry go around. The ideal types for Akron appear to be sewers and buildings, because most of the materials can be produced here and the relief rolls contain the names of many tradesmen just suited for these jobs. Vitrified pipe sewers constructed with Akron made pipe are 75% to 85% local labor.

"Another thought that naturally arises in the mind of the engineer is, that as the solution of the manufacturer's problem lies in distribution of his product, so by the same token the problem of labor is largely one of distribution after the funds for hiring the labor have been provided. The answer to the hypothetical question, "If there are ten million scattered men out of work and there is a single project for which ten million men are wanted, with attractive pay, guaranteed, how will be men be secured?" is easy to answer: The real men would flock to the site of the work as in a gold rush, the drones would have to follow or go hungry, unemployment would end almost immediately, and industry would soon find itself short of help because orders for new equipment and materials are drifting in from the public work project. A redistribution of labor would be a real benefit to all."

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Cletrac being a crawler does not pack the snow—yet it goes through where other types slip and stall because it has more usable h. p. per foot of plow.

Cletrac power is economical—Model 25 for instance, costing less than a dollar an hour.

The new Model EN Cletrac, with 22 drawbar h. p. is only 42 inches wide—narrow enough for residential sidewalks. It cleans clean in one trip, at 4½ miles an hour—a mile in 14 minutes.

Write for new broadside describing nine Cletrac models (including 40 and 80 h. p. 6-cylinder Diesels) and snow plows for all types of snow removal work. Whatever your specific needs, Cletrac equipment meets it—most efficiently and economically.

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When you need special information—consult the *classified* READERS' SERVICE DEPT., pages 51-53

Ice Control in Rochester, New York

By E. A. Miller

Supervisor of Maintenance, Dept. of Public Works, Rochester, N. Y.

Type of sand spreader used by Rochester for distributing the cinders-salt mixture—the "Good Roads Champion"

LAST year the city of Rochester, N. Y., faced with a limited budget combined with requests that its ice control service be extended to include more street intersections than formerly, decided to use a mixture of cinders and rock salt, which was less expensive than the chloride it had used before, and to apply it to all intersections controlled by stop signs and traffic lights and to all dangerous grades and curves.

Why We Used Salt

We decided on the use of rock salt after studying the report of the Committee on Icy Pavements of the Highway Research Board, Volume 13, which presented facts and figures showing how effective salt is at the temperatures usually encountered during sleet storms and snow flurries in northern New York. Prior to adopting its use we investigated its effect on metal. We found that railroads were using it satisfactorily, and that railroad equipment was not rusted more than could be expected considering the number of years it had been used, and that rust due to salt would be no greater than that caused by any other chemical. After salt had been in use for some time, inspection of city equipment and of many cars parked at the curbs showed practically no rust that could be traced directly to the effect of salt; cars in other cities where salt was not used were just as badly corroded. Special study of chrome plate on headlights, bumpers and hub caps indicated that salt was less corrosive to this than were other chlorides which had been used formerly for melting ice and snow.

The grade of salt used was commercial CC size rock salt, this being selected because it remains free running and will not cake in bag or bulk storage, and because it does not dissolve so rapidly as smaller sizes of salt and other chlorides used for this purpose. The crystals of rock salt stay on the job while the ice is forming and gradually cut their way through to the pavement, maintaining a strong brine which undercuts the ice when it reaches the pavement, enabling automobiles to break up the ice and mix it thoroughly with the brine and any undissolved salt. In this way the salt and the brine keep on working even after the streets are made non-skid. During the melting and breaking up of the ice the cinders become thoroughly imbedded due to the action of the salt and traffic.

One thing we noticed in particular last winter was that after the salt had melted the ice, the roads dried off quickly, leaving no thin film of brine to freeze at night and make an icy surface where it would be least expected and take the motorists unaware.

Method of Applying Salt

The mixture of cinders and salt is kept in three large storage bins located in different parts of the city. The cinders are purchased by contract and furnished as needed during the winter, being delivered at the storage bins by trucks. At the approach of freezing weather we begin filling the bins, adding salt at the rate of 25 lbs. per cubic yard of cinders, which is sufficient to keep the cinders from freezing; further protection from the weather being given by covering the bins. Later, when the cinders are loaded into trucks for use, an additional 25 lbs. of salt is added, making a total of 50 lbs. per cubic yard of cinders, which amount proved very satisfactory last winter. In regions colder than Rochester it may be advisable to use two or three times this amount. As fast as the cinder and salt mixture is withdrawn from the bins for use, a new supply is added so that they are kept full at all times.

Fall and Winter Work

Before the icy season begins we schedule our ice control routes, giving first choice to those street intersections which carry the greatest amount of traffic, as determined by traffic surveys made with the cooperation of the Rochester Engineering Society. We feel that the greatest good can be done by treating these prominent intersections first and then proceeding to the less traveled districts. Each truck has a scheduled route carefully planned, which it is the duty of its crew to cinder as quickly as possible when orders for cindering are given.

During the winter season we receive daily weather reports from both the Weather Bureau of the Dept. of Agriculture and the Dept. of Commerce at the airport, and with this splendid cooperation are able to get our crews on the job quickly when a storm occurs. At the approach of a sleet storm or light snow storm with falling temperature, we order our ice control crews to stand by at their respective stations, and start them off when

(Please turn to page 24)

SNO-PLOWS, NOTHING ELSE

All of our time and energy are concentrated on building the best and most effective snow plows. The line includes both "V" type and one way type plows for every make of truck.

Why Highway Departments Prefer FRINK SNO-PLOWS

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B. ABSENCE OF SIDE THRUST—Even when widening out with only one side of the Sno-Plow.

C. PUSHES EASIER—raises the snow to prevent wedging or cramping.

D. BEVELS THE SIDE BANKS—to restrain the snow from falling back into the cleared space.

E. WILL NOT WEDGE—no matter how hard you hit a snow bank.

F. LIGHT YET RUGGED—scientifically designed without excess weight.

G. LESS UNSPRUNG WEIGHT—reduces repairs on truck axles, wheels and tires.

H. SAFETY AT HIGH SPEED—Does not throw snow onto windshield.

I. NOSE ICE PLATE—permits removal of traffic-packed and rutted snow.

J. ADJUSTMENT WITHOUT TOOLS—appreciated by operators in cold disagreeable weather.

K. QUICKLY ATTACHED AND DETACHED—truck attachments are simple and most convenient.

L. INTERCHANGEABLE with One Way Blade Type —same truck attachments used for "V" Type or One Way Type Sno-Plows.

Frink Sno-Plows have built up an enviable reputation for quality of their product and for service to their customers. Every possible effort is made to maintain and add to that reputation. You also will be pleased with FRINK SNO-PLOW EQUIPMENT and FRINK SERVICE.

Our new 24 page catalog contains definite information which will help you to select the type of snow plow to suit your requirements. It explains the Power Hydraulic Control, the Leveling Wing, tells how to select the right Sno-Plow and Leveling Wing for your trucks.

• *Before you order snow plows, be sure to write for a copy of the Frink catalog describing a complete line of snow plows which are giving satisfaction throughout the snow belt. Write for a copy today.*

H. FRINK, Manufacturer

THOUSAND ISLANDS, NEW YORK

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FRINK SNO-PLOWS of Can., Ltd., Toronto, Ont., Canada

the sleet or snow has covered the pavement sufficiently to endanger traffic. The important intersections are treated while the sleet is forming and thus protection is afforded during this critical period as well as after the storm has ended, no glare of ice forms on the pavement and motorists are given a sense of security as they reduce speed or apply their brakes.

Each intersection is cindered on the side of approaching traffic for a distance of about 30 feet back from the intersection. Automobile tires carry the salt and some cinders for considerable distance, which action is often sufficient to make the ice non-skid from one treated intersection to another.

The treated cinders were spread from the trucks by either shovels or mechanical spreaders. By the former, one man at the rear end of a truck spread cinders at the rate of about 1½ to 2 pounds per square yard by throwing them with a hand shovel; but they were spread much more uniformly and a less amount used when distributed by a mechanical spreader hooked on behind a truck, which was operated by two men.

On either country highway or city street it is advisable to remove sand or cinders after all the ice has been melted but this is not often done. The abrasive accumulates along the sides or roads and at the foot of grades to such an extent that it is sometimes dangerous to traffic. And accumulated abrasive is injurious to all types of pavement. Cinders are removed from Rochester streets and gutters by the street cleaning crews after every sleet or snow storm. They were used last winter to build up the surface of our cinder streets, which use proved an economical method of applying cinders to street surfaces in outlying districts.

In Snow Removal

We begin plowing snow when it has reached the depth of three inches and continue plowing until the snow quits falling. By following this method, we are able to prevent much snow packing on the streets, even in the business section. After heavy snow storms, there is always left on the pavement a small amount of packed snow which could not be removed by the plow. When this packs or freezes, it creates a traffic hazard almost as great as sleet or the glaze left after a light snow which occurs during falling temperature. The snow plows therefore are always followed by the cinder trucks, and all intersections cindered as soon as possible after the snow plow passed through.

We found that salt and cinders acted equally as well on packed snow as it did on ice. It was not long until traffic had worked the salt and cinders into the snow enough to loosen it up so that it could be removed or shoved to one side by the wheels of automobiles.

Results

We are satisfied that our ice control program last winter gave better satisfaction than it had ever done in the past, because this is the only year that we received no criticism from the local Board of Underwriters concerning the manner in which we carried on our safety campaign.

Although there has been an increase of 50% in the number of automobiles in the city of Rochester in the past ten years, causing an increased amount of traffic over the city streets, last winter was the first time that we considered we were doing a satisfactory job of making the streets safe for travel. Last winter's program was so successful in keeping down traffic accidents due to icy conditions, that we are planning to extend our routes for the coming winter and so increase the safety of travel over our streets.

Accident Prevention and Ice Control

Methods and Results in a Number of States, Counties and Cities

Ohio

We have found that slightly over 50 per cent of the accidents on our highways are caused by slipping or skidding on the pavements. Unfortunately, at the present time we have not differentiated between slipping due to ice and snow and slipping due to wet pavements or ordinary pavements due to excess speed. There is no question but that a large percentage of this 50 per cent are accidents caused by slipping on icy pavements.

In addition to the snow removal equipment, Ohio has 184 spreaders for applying cinders or other abrasives on icy pavements.—*By Carl G. Wahl, Assistant Director, Department of Highways.*

Vermont

Up until last year it had been our policy to sand only the hills and curves when icy, but public demand made it necessary to change this policy and to sand all icy places. This has cut down the number of accidents. To accomplish this, 45 new sand spreaders were purchased this last year.—*By H. E. Sargent, Commissioner, Department of Highways.*

Springfield, Mass.

Slippery pavements due to ice formation have been direct or contributory factors in causing accidents in our community. To combat this condition we have set up a system of sanding, in an endeavor to reduce the number of accidents to a minimum.

We have seven sand spreading machines which are attached to 1½ ton Ford trucks. They are very rapid in action and are constantly kept loaded during our winter season ready to be dispatched to any designated location, upon notice of the existence of a dangerous condition.

We have also successfully used calcium chloride mixed with water or mixed dry in sand. Calcium chloride solution is used extensively in our downtown street area to prevent ice freezing on these pavements. We find that 100 lbs. of calcium chloride mixed with 13 gallons of water proves very effective in the prevention of ice formation on our highways.

A stronger solution than 100:13 is likely to cause damage to automobile equipment and to the clothing of pedestrians in the event of their being accidentally splashed with the mixture by passing traffic. It may also have some slight undesirable effect on certain types of pavement.

Mixed dry in the proportion of 400 lbs. calcium chloride to 10 tons sand and spread on icy steep grades and sharp curves, it aids greatly in eliminating a very dangerous condition. The reaction of the ice coating to the dry mixture seems to be that the coating tends to peel off in small slabs rather than to disintegrate and churn to powder under the wheels of traffic.

This makes the eventual removal of the sand and ice easier and more economical.

Seven spreaders are used by the city for this work.—*By Cornelius W. Phillips, Superintendent of Streets and Engineering.*

Other contributions will appear next month.

When you need special information—consult the *classified* READERS' SERVICE DEPT., pages 51-53

Snow Removal Methods on Michigan State Highways

By H. C. Coons

Deputy Commissioner-Chief Engineer, Michigan State Highway Dept.

DOES snow removal pay? While we can furnish no definite figures to prove that it does, from certain statistics which we have investigated we believe that the cost of snow removal is more than offset by the gas tax receipts alone.

H. C. Coons

In that portion of our State above a line east and west through Bay City, if snow removal was discontinued automobile traffic would be at a standstill during most of the winter. A large number of villages through the upper part of our State grew up along railroad tracks built for the purpose of removing the timber during the height of the logging operations, but since the timber has been cut off, these railroad tracks have been removed and consequently these villages have no other connection with the rest of the State except by the highways; therefore, if snow removal was discontinued these towns would be completely isolated. Since it is believed that the gas tax receipts from cars kept in operation by the removal of snow pays for the snow plowing, any business transacted by means of automobiles and trucks over the highways that are kept open can be considered a profit to the communities and State as a whole.

At the present time, many of the smaller schools in the outlying district have been discontinued and the children are being transported to and from school by means of buses. It is, therefore, necessary that these roads be kept open so that the children can receive this education which would otherwise be denied them.

Logging operations are carried on at the present time over trunk line highways, logs being hauled from the woods over these roads by means of trucks and trailers.

Winter sports carnivals are held at various points throughout the State. All such activities would be stopped if snow removal on the State trunk lines was discontinued.

Is there a popular demand for snow removal? In addition to the above it can be said that the people of the State of Michigan demand that the roads be kept not only passable but in such shape that travel over the trunk lines can proceed with almost the same rate of speed as during the summer time. Every effort is made by the Highway Department to keep all roads on the snow removal program open to traffic at all times. Only in rare instances have any roads been blocked during the last two years and then for only a few hours at a time and in isolated spots.

During the winter of 1934-1935, 8,721 miles of State trunk line roads were kept open for wheel traffic out of a total of 8,802 miles in our system. Some additional mileage will probably be added to this program during the coming winter.

Ice Control

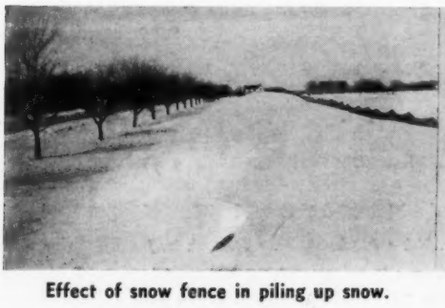
Ordinarily, sanding is done only on hills, road and railroad intersections, curves, etc., but during the last two years the lower portion of the State has been covered with ice and sleet at frequent intervals and has created such hazards that it has been necessary at times to sand some of the main trunk lines over their whole length.

Each fall the Highway Department produces and stores a certain amount of sand at regular intervals along the highways, adding approximately 50 pounds of chloride per cubic yard of sand to prevent its freezing. When roads are covered with ice, the sand is hauled out and spread by means of rotary spreaders attached to the rear end of the truck. If the ice is very hard, a small additional amount of chloride is added during this distribution in order to make the sand imbed itself in the sheet of ice. Care must necessarily be exercised in the use of chloride, since it has a tendency to accelerate the scaling of concrete pavements where it is used.

Equipment Used

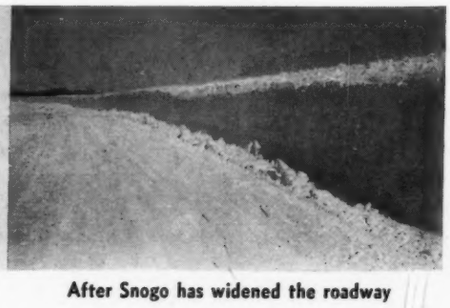
As to equipment, trucks with plows mounted on the front are used almost universally. The tractor and plow are used principally in emergencies where drifting is so severe that the truck and plow are unable to keep the road open. In the areas where the snow fall is heavy, the V type plow is used for the heaviest work and is augmented by the lighter plow which is used as a clean-up plow. This type of equipment is much more economical because of the speed at which it can be operated.

During the earlier part of the winter the snow is plowed away from the highway as far as possible to allow for future storage at the sides during storms occurring later in the year. There are times, however, when snow gets piled so high that it acts as a snow fence and the trench made by the plows will be drifted full. In these cases the rotary plow and the plow which is known



Effect of snow fence in piling up snow.

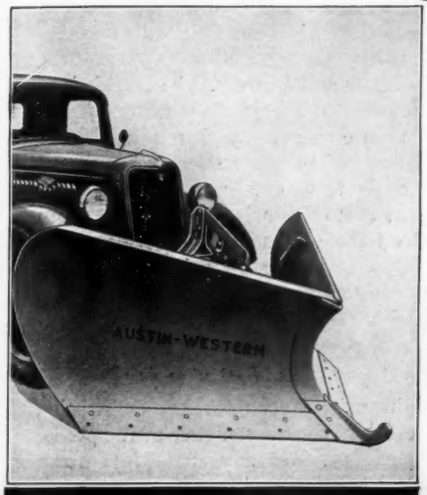
Looking at a Snogo from the rear.



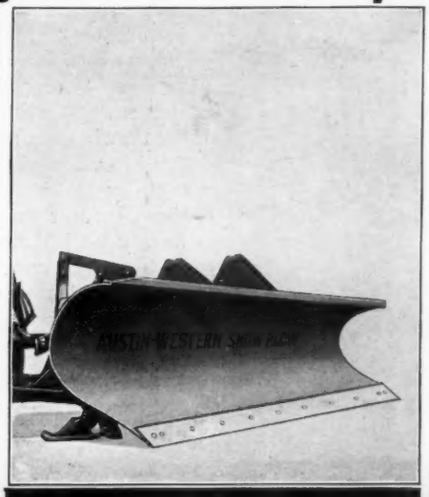
After Snogo has widened the roadway

This Winter...

avoid the high cost of delayed snow clearance



The Austin-Western V-Type Plows because of their weight distribution clear drifts at a minimum of strain on the truck.



The one-way plow for clearing streets at high speeds has a blade curvature in excess of the reversible blade. This extreme curvature reduces friction by rolling the snow, while eliminating its tendency to fly over the blade and back against the truck windshield.

Austin-Western reversible plows may be set at any angle for casting snow on either side, or for bull-dozing as conditions require.

Features of the AUSTIN-WESTERN SNOW PLOWS

1. Built for 1½-ton to 2-ton and 2½-ton to 5-ton trucks.
2. Standard push frame. Fits all types of of Austin-Western Plows.
3. Hand hydraulic controls are standard equipment.
4. Mounting and demounting extremely simple.

● The faster your snow plows get on the job during a storm the easier it is to clear the streets—the greater is the saving to the taxpayers and the general public.

It is false economy to save on the cost of one or more snow plows only to spend a hundred times that amount in bucking drifts that have had a chance to form and shoveling out impassable sections by hand. This wastes the community's money to say nothing of the losses to business.

Ask your nearest Austin-Western dealer to estimate the minimum number of plows that you will need based on the number of miles of streets and roads you have to keep clear.

Or, use the coupon for further information.

The Austin-Western Road Machinery Co.

Home Office: Aurora, Ill. Cable Address: AWCO, Aurora

Branches in 14 Principal Cities

ROAD GRADERS · MOTOR GRADERS · ELEVATING GRADERS · DRAGS

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DUMP WAGONS

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CRUSHING AND WASHING PLANTS · SWEEPERS AND SPRINKLERS · SHOVELS · CRANES · ETC · SNOW PLOWS

The Austin-Western Road Machinery Co.
A-5, Aurora, Illinois

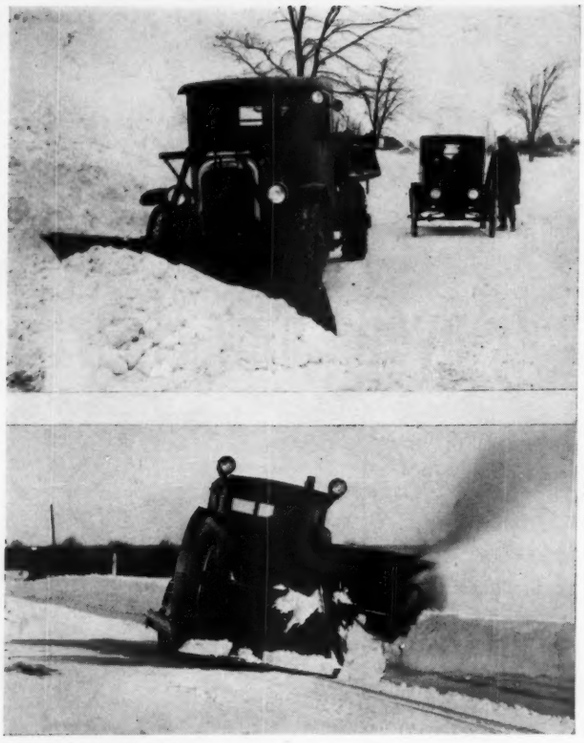
Please send details on.....type snow plows.

Name.....

Address.....

City.....State.....488

When you need special information—consult the *classified* READERS' SERVICE DEPT., pages 51-53



Above—Reversible plow.
Below—Widening a cleared road with a rotary plow mounted on a 10-ton tractor.

as the "Snogo" are used to throw the snow back from the road. These pieces of equipment throw the snow as far as 50 feet back from the traveled portion of the highway. This equipment is used also in case of a blockade during severe wind storms.

The Michigan State Highway Department now has in use 640 miles of snow fence for the prevention of drifts along the highways. This fence is of the vertical slat type, four feet in height. It is supported by steel posts driven in the ground in the fall and so attached to them that it can be raised from time to time during the winter so that it will at all times be effective.

The State Highway Department has no plans of buying any additional equipment except for a few truck plows to replace obsolete equipment and such plows as are necessary for any additional mileage that may be added to the program.

Dust Control in Michigan

Michigan has a large mileage of gravel roads. Because large deposits of gravel, suitable for road building, exist throughout the State, this type of road can be built economically. Gravel roads, however, are very dusty during dry weather and it is necessary to apply some form of dust palliative, for which purpose calcium chloride and oil have been used. Chloride is applied in three applications totaling from eight to ten tons per mile, while oil is applied in three applications totaling 4,000 gallons per mile.

In 1933, chloride was applied to 3,218.7 miles of road at a cost of $542,466.75 and oil to 141.7 miles at a cost of $18,237.16. In 1934, chloride was applied to 3,181.4 miles at a cost of $458,785.43 and oil to 153.7 miles at a cost of $27,268.56. The price of oil in 1933 was four cents per gallon, and in 1934, was five and one-half cents per gallon.

Profits from Snow Removal

Replies by City and State Highway Officials to the Question "Does Snow Removal Pay?"

Answer to the question "Does snow removal pay?" would depend upon whether you really mean snow *removal* or snow *plowing*. The cost of plowing is rather insignificant compared with the cost of removal. This difference is so great it seems to me a distinction should always be made. There is no doubt in my mind about the economy of snow plowing. Pavement surfaces are seriously damaged where sufficient snow is left in the roadway to result in snow and ice ruts. The tracking of vehicles together with the confining of the water during the thawing hours in these ruts results in repair expense far in excess of the cost of plowing snow. The cost of entirely removing snow from city streets is so many times greater than the cost of plowing that this cost can hardly be justified on the ground of direct saving in maintenance cost. It is, of course, justified in business centers and narrow congested streets from a traffic and commercial point of view.—*Leon F. Peck, Superintendent of Streets, Hartford, Conn.*

Does snow removal pay? Emphatically yes.

From the standpoint of true economy, the facilitation of the flow of business, and the convenience of the public in general, our experience, over a period of years in Springfield, Massachusetts, compels this answer.

We have no hesitation in saying that proper snow plowing and removal certainly lowers the spring maintenance cost on pavements and streets.

Some eight or nine years ago, the City of Springfield, actuated by a laudable desire to save money, curtailed, to a considerable extent, the necessary expenditures for snow plowing and snow removal. This proved to be a policy of false economy. Heavy ice ruts were set up in our principal thoroughfares and at street intersections, creating a tremendous hazard to vehicular and pedestrian travel and also necessitated proportionately large expenditures for pavement repairs during the ensuing summer.

We have found that heavy traffic running through and over ruts of ice and snow for any extended period of time, will inevitably cause a breakdown of the top fabric of the pavement, allowing moisture and water to penetrate to the base doing serious damage to the whole structure during time of alternate freezing and thawing.

Local business must necessarily benefit from our program of snow plowing and removal, which is very efficiently organized, and while no comparative figures are available, the wholehearted support and approval we receive from our merchants, manufacturers, and buying public, is pleasing testimony to this fact.

Clean streets and sidewalks, especially during the dark, dull days, are a proven asset to the business life of any community. Business indexes show that the buying public rightfully demands high class service and will not "shop," except when compelled by sheer necessity, when or where conditions are uncomfortable.

The city of Springfield during the past sixteen years has placed considerable stress on the question of snow plowing, snow removal, and sanding, fully realizing the importance of these three functions in the life of the community. Our successive city governments have been

cooperative in an endeavor to supply us with the best and most modern equipment available as well as the necessary funds to carry out our snow operations.

Our records show that from 1928-1934 slightly more than $1,000,000 has been expended on snow removal operations in this city, and as a result the Department of Streets and Engineering has been able to render to Springfield a service that is felt to be invaluable from the viewpoint of business, traffic, and safety.—*Cornelius W. Phillips, Superintendent, Department of Streets, Springfield, Mass.*

In regard to the question of returns from snow removal work, there is, of course, certain increased revenue through operation of motor traffic over routes which would otherwise be closed for several months, but this in general would not pay the extra costs involved. There is no reduction in the cost of the maintenance of the road, as it has been our experience that the operation of the heavy snow removal equipment and the freezing and thawing, coupled with the action of traffic, more rapidly deteriorates the road and increases the maintenance costs. The benefit to business and people generally in having an open road is, of course, the main return and from our point of view justifies the expenditure where there is any appreciable volume of traffic and business to be conducted.—*T. H. Dennis, Maintenance Engineer, California Division of Highways.*

In my opinion snow removal does pay not only through the savings resulting in maintenance work, but also in the increased local business. In the first place, in any community which is more or less metropolitan combined with suburban, such as ours is, the public demands that snow be removed from all of the highways which are traveled to any considerable extent. Many people who either work or have business in the city live in the suburban and rural areas and villages surrounding the city. Regardless of how severe the snows are, these people expect to get up in the morning and drive their cars into town. Our maintenance crews are under standing orders to get out on the roads with the proper equipment at any time day or night, when conditions look as though the roads would need clearing. We find that this works very effectively rather than to have them wait to be ordered out.

We try to move the snow completely off the improved section of the road and into the ditches as much as possible. This naturally allows the melting snow to drain off through the ditches rather than into the sub-grade and shoulders. This is particularly advantageous in the case of traffic-bound and bituminous surface-treated roads. Likewise, when freezing takes place before all of the snow has melted, it is better to have it freeze out alongside of the road rather than on the surface.

Frink V-plow used in widening

Above: Austin-Western "77" dual drive motor grader, with front V plow and snow blade in place of the regular grading blade. Widening a road.

Below: Austin-Western one-way snow plow (tapered blade) operating at Stratford, Conn.

In the section where local buses and trucks, as well as passenger cars, are moving daily there is no question but what business is benefited considerably if this traffic is allowed to move without interruption. The same thing is true in the case of the farmer bringing in products which he may have stored for sale during the winter months and making his purchases in the cities.

Another very important matter which must be considered is that of accidents. This perhaps is not as outstanding in the case of snow as it is where icy conditions have to be contended with.

It is very difficult to make any estimate as to the savings resulting from snow removal in connection with any of the above mentioned items. We know, of course, definitely, that there is a saving in maintenance due to the fact that the roads are not subjected to so much damage as they would be if the melting snow were allowed to remain on them; we also know that it enters into the matter of business and also accidents as mentioned, but to break this down into dollars and cents would be nothing more than a guess and I am of the opinion that there is no one who might be able to guess it correctly.—*H. G. Sours, County Surveyor, Summit County, Ohio.*

Unfortunately, we have no records which definitely prove whether or not snow removal pays. We feel, in this Department, that unquestionably it does pay to promptly remove snow on all of our main highways. We endeavor to keep all of our highways in the State passable at all times of the year. In this connection I refer only to the 12,000 miles which we maintain.

It is our opinion that the increased revenues from gas tax alone more than pay for the cost of removing snow. —*Carl G. Wohl, Assistant Director, Ohio Department of Highways.*

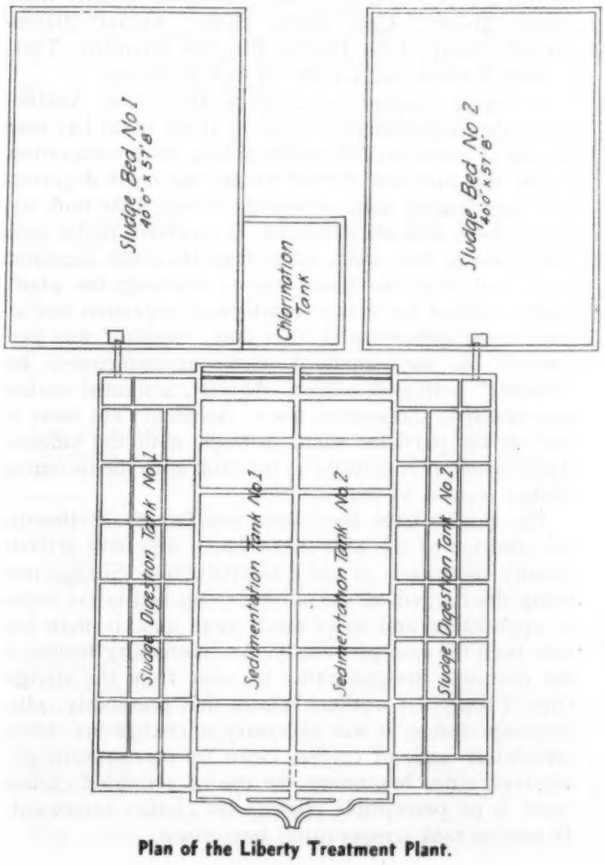
Experiments in Chemical Sewage Treatment at Liberty, N. Y.

By W. A. Hardenbergh

INTERESTING results in the chemical treatment of sewage have developed in the work which has been carried on at Liberty, N. Y., during the past year. An outline report of conditions at this plant, of the methods used, and of the general results obtained are presented here as indicating the possibilities in this method of treatment.

The Plant. The existing plant consists of a screen; two settling tanks equipped with Link-Belt sludge removal apparatus, which provide a detention period of 3 hours for the estimated maximum summer flow of 1,125,000 gpd.; two sludge digestion tanks, which provide a capacity of 3 cubic feet per person for the average annual population; covered sludge drying beds; and chlorination. The plant was constructed in 1931 from plans prepared by A. P. Folwell and the writer; the cost was $36,300 complete.

Sewage Characteristics and Dilution Available. Liberty is a popular summer resort, and during the summer months both the amount and the strength of the sewage are markedly above the yearly average. The flow averages about 750,000 gpd. during July and August, but may be considerably greater over the week-ends. During the fall months, it drops to about 650,000 gpd. The strength of the summer sewage is unusually high, due to milk, laundry and slaughter-house wastes. Tests made last year indicated BOD of 300 to as high as 700. The pH is normally high, ranging during the summer up to 8.6 or even higher.



Plan of the Liberty Treatment Plant.

The drainage area of the Mongaup Brook above the plant discharge is less than 10 square miles, and the dilution during dry periods in the summer months is often not much more than 1:1. No secondary treatment was provided at the time the plant was built, largely because of the costs involved and the limited funds available. The problem is serious only during 100 days in the summer, and to care for this period it was believed chemical treatment would prove the solution.

Preparation for Chemical Treatment. During the fall months of 1934, some experimental work was carried on using various chemicals, which were applied at a point near the village about 1½ miles upstream from the plant with the hope that the passage through the 18-inch sewer would produce the necessary mixing and coagulation, so that proper settling would take place in the settling tanks. In general, these results were not satisfactory. A pin-point floc formed which would not settle out.

During the winter a number of conferences were held in which suggestions and advice were received from a large number of chemists and engineers, including Messrs. Agar, Healy, Brendlin, Enslow, Bingley, and Phelps, as result of which it was decided by Paul Johansen, Sewer Commissioner of the village of Liberty, and John Lawrence, Superintendent of Public Works, to construct a chemical mixing tank at the site of the plant for the season of 1935.

Mixing. This tank was designed by the writer, generally on the basis of the harmonized recommendations of the men mentioned above, plus Messrs. Tark and Gilbert of the Link-Belt Co. There was a diversity of opinion as to the advantages of air-mix as compared to mechanical mixing, and the tank was designed so that air mixing could be used primarily, but bolts were set and other provisions made so that mechanical mixing apparatus could be installed in it if experiences with air mixing were not satisfactory.

The Link-Belt Co. loaned the village an air-mix outfit, including a motor, blower and Norton porous tubes. Wallace & Tiernan Co. furnished a dry-feed mixer and a chlorinator; chemicals were furnished by or purchased from the Merrimac Chemical Co., the Krebs Paint and Pigment Co., Innis, Spieden & Co., Industrial Chemical Sales Co., Inc., and Calcoag Chemical Co. The W. & T. dry feeder was used for applying lime, and a Phipps & Bird solution feeder for all solutions.

It was early demonstrated that much better results were attained by the application of the chemicals at the plant rather than at the dosing point near the village, and this latter was abandoned, except that lime and chlorine were added there. It was also early shown that the amount of air provided, 5 cubic feet per minute per foot length of the mixing tank, was excessive, and this

was cut down to about 2 cubic feet per foot of tank, which required the substitution of a smaller and lower speed motor.

The mixing tank was of the Link-Belt aerator type, 8 feet wide, 8 feet deep and 34 feet long, with baffles. The general plan of this tank is shown in the accompanying illustration.

Experiences with Chemicals. Under the direction of Messrs. Healy and Abbiati of the Merrimac Chemical Co., the plant was started using "Ferrisul," with a dosage of about 110 parts per million, plus prechlorination and the addition of about 110 parts per million of lime at the upper dosing point. The chemical treatment was carried on from 7 A. M. to 7 P. M., during which time something like 65 per cent of the total flow passes through the plant.

Using "Ferrisul" an excellent effluent was obtained; and this also was the case with chlorinated copperas, which was applied under the temporary direction of Mr. Baumgartner. BOD results on these tests are not yet available, but previous laboratory tests have shown that it was possible to reduce the BOD to around 40 or even less by the use of these chemicals.

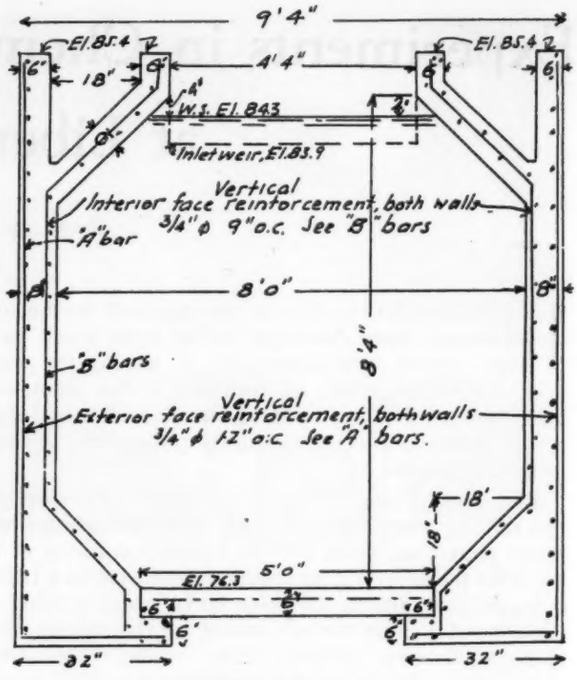
Blackalum, supplied by the Industrial Chemical Sales Co., was next tried, and when used at the rate of 500 pounds per day gave very fine results, the effluent from the settling tanks being practically clear and colorless. When this chemical was used, it was not necessary to prechlorinate or to use lime, and the final chlorine dosage could be reduced while maintaining the desired residual.

Application of Chemicals—After discontinuing the use of the uptown dosing point, chemicals were applied at a manhole about 50 feet from the mixing tank. There is a drop of about 5 inches in the inlet structures of the settling tank, resulting in considerable agitation of the entering sewage, and trouble occurred due to the breaking up of the floc particles in the rather rough journey from the mixing tank to the settling tank inlets. The feeder was then moved to the entrance of the mixing tank, and better results were attained this way, though there still was some difficulty from the same cause. The volume of air was then cut down and a relief valve installed (this was before the small motor was substituted); following which, at the joint suggestion of Mr. Lawrence and Mr. Gilbert, the air volume was still further reduced, with the valves in only the first third of the tank wide open, while in the remainder of the tank only enough air was applied to keep the sewage rolling.

When so operated, floc particles passing over the outlet weir of the mixing tank were not so satisfactory in appearance, but final results were much better. It is the opinion of Mr. Lawrence, who is a very keen and interested participant, and also the opinion of the writer, who has participated in and observed the work over the entire period of time, that it should not be necessary to provide a streamline, or super-smooth riding, flow for the coagulated sewage in its passage into the settling tank, and that a floc so delicate as to be unable to withstand some whirling and agitation will not give such good final results.

After further observations, Mr. Lawrence moved the feeding point for the chemicals to a point about one-third of the way from the inlet end of the mixing tank, following which there was a decided improvement in both coagulation and settling, which may have been due to the premilinary aeration of the sewage and the shortened time of mixing.

The man in general charge of the work, Mr. Lawrence, is primarily responsible for the carrying on of the entire program, and his native ability and keen observation have been the most important factors in attaining these very promising results. The chairman of the Board of Sewer Commissioners, Paul Johansen, has also been active and interested. With Harry Eichenhower, the plant operator, this trio have accomplished a very fine job. A great deal of credit for hard work, advice and helpful interest is due to the gentlemen already mentioned: Messrs. Agar, Kelly, Healy, Abbiati, Baumgartner, Stuart, Ellis Phelps, Bingley, Brendlin, Tark, Gilbert, Enslow and Griffin, as well as others.



Section through mixing tank.

Activated Carbon and Sludge Digestion. Another interesting experiment carried on at the plant has been the use of activated carbon for aiding sludge digestion. Under the direction of Fred Stuart, the north digestion tank was seeded with activated carbon. This tank has always been difficult to handle. It received, under most conditions of flow, more solids than the south digestion tank, and with the trade wastes reaching the plant, sludge control for really satisfactory digestion has always been difficult with this tank. Seeding was performed on the standard basis recommended for "Nuchar" activated carbon. At first, activated carbon was added to the sewage above the plant; but some of the carbon particles came through with the effluent. Application of it directly to the tank with the incoming sludge seemed to remedy this.

The results have been most satisfactory. Following the addition of the activated carbon, digestive activity greatly increased, as did gas production. Sludge now being discharged on the north drying bed is far better in appearance and dries much more quickly than had ever been the case previously. An interesting feature is the complete disappearance of odor from the sludge. One of the plant workers relates that previously, after drawing sludge, it was necessary to change his clothes completely and, of course, clean up correspondingly; whereas, since beginning the use of activated carbon, there is no perceptible odor to his clothes afterwards. Digestion tank temperatures have risen.

State Hospital Sewage Disposal Works

By Henry Ryon

Senior Sanitary Engineer, New York State Department of Public Works

THE sewage disposal works of the Hudson River State Hospital, Poughkeepsie, New York, consists of a grit chamber, mechanically cleaned bar screen, glass covered clarifiers, sludge pumping plant, a sludge digestion tank, glass covered sludge beds, a chlorinating plant, and a chlorine contact tank.

The works was designed for a population of 6,000 persons and a sewage flow of 1,200,000 gallons per day.

The Units

Grit Chamber—Size 20 feet by 6 feet, depth variable; velocity through chamber 1 foot per second.

Screen—Channel 3 feet wide by 3 feet deep; screen ⅜ inch by 2 inch bars 1 inch apart; continuous mechanical cleaning.

Clarifiers—Two 40 feet square, 7 feet deep; capacity (both) 160,000 gallons; detention period (both) 3.2 hours average flow; rotating mechanical cleaners with skimmers.

Sludge Pumps—Two single cylinder diaphragm pressure pumps; cylinder 16 inches, stroke 0—3 inches; capacity 5.7 g.p.m. (each).

Sludge Digester—One 40 feet in diameter 14.5 feet deep, equipped with stirrer and scum breaker; capacity 18,000 cubic feet, 3 cubic feet per capita; heated with hot water coils from gas and coal heater in sludge pump house.

Sludge Beds—Two glass covered, 74.3 feet by 38.7 feet each; area (both) 5,750 square feet, 0.96 square foot per capita; filtering material, 12 inches of sand.

Chlorination—Duplicate solution feed chlorinators arranged to pre-or post-chlorinate, or both.

Chlorine Contact Tanks—One 34 feet by 8 feet, 4.3 feet deep; capacity 9,500 gallons; contact period, 11 minutes plus outlet sewer.

Cost—Cost of works complete, $94,556.07.

Operating Data

AVERAGE JANUARY-APRIL 1935

Population served	5,500
Water consumption	1,000,000 g. p. d.
Screenings	5.9 c. f. p. d.
Pieces returned to laundry from screen	123 per month
Settleable solids—	
Raw solids	2.8 c. c. p. l.
Settled sewage	0.15 c. c. p. l.
Percent removed	95%
Solids in raw sewage (composite, 8 hours, day)—	
Total solids	642 p. p. m.
Loss on ignition	478 p. p. m.
Suspended solids	174 p. p. m.
Lime added to sludge	940 lbs. per mo.
Sludge—	
pH (digester)	7.0
Fresh sludge—	
Solids	7.4%
Volatile	52.0%
Digested sludge—	
Solids	10.5%
Volatile	37.0%
Chlorination—	
Prechlorination	30 p. p. d.
Postchlorination	50 p. p. d.
Residual chlorine	0.54 p. p. m.
Bacteria—	
Raw sewage	1,700,000 p. c. c.
Chlorinated effluent	302 p. p. c.
Chlorinated effluent, B. coli absent in	1.0 c. c.

The mechanical screen used was manufactured by the Dorr Co., as were the clarifier and the digester. The sludge pumps are of the Dorr-Barnes type. The chlorinator is a Paradon.

This description was presented by Mr. Ryon at the Peekskill meeting of the New York State Sewage Works Association.

Raising Sunken Pavements by Mud-Jacking

The raising of sunken Portland cement concrete pavements to their original grade by "mud jacking" has been carried on in California since 1931, the mud-jack unit being kept busy practically all of the time since then.

Throughout, particular attention was given to the quality of the muck used. It is desirable to use as stable a material as possible to reduce shrinkage and further settlement. This result is obtained by the selection of sandy loam of as coarse a grading as will produce a mixture which can be forced into place.

The mud jacking crew, as used in California, consists of a foreman, two equipment operators and three laborers, and the equipment consists of the following:

1 mud jack (mounted); 1 compressor on 1½-ton truck; 1 600-gallon water tank on 1½-ton truck; 1 dump truck (part time); 1 light express automobile; 1 jack-hammer, 1 pavement breaker; 1 Hauck pavement burner; drills and small tools.

The cost and quantities of this work as performed from May 15, 1933, to June 15, 1934, are as follows:

Labor	$11,273 87
Equipment rental	8,239 60
Cement	1,603 75
Supplies	1,787 68
	$22,904 90

Material used:

Cement	3,014 sacks
Muck	2,784 cubic yards
Water	165,050 gallons

Area of pavement raised 40,237 square yards.

The pavement raised varied from 7″ x 20′ sections to 7″-9″ x 60′ and 9″-11″ x 30′ sections. The vertical distance raised varied from 0.6 inch to 4.4 inches with an average, based on the quantities given above, of 2½ inches.

The average unit cost amounts to $0.588 per square yard. The cost of muck and cement in place and not including the water is practically $8 per cubic yard. At first glance this cost seems high for filling material but when it is considered that the riding quality of the pavement is greatly improved and the uniform appearance of the concrete surface preserved, it is considered that the method is well justified as compared to surface patching, even though the cost is slightly higher.

In Michigan, six mud-jack units are used, and pavement slabs are raised from 2 to 18 inches. The cost varies between 50 and 60 cents per square yard, which is cheaper, by far, than replacement and more satisfactory than other means for obtaining a smooth surface.

Surveys and Estimates for Local Road Improvements Under WPA

A number of inquiries have reached us as to methods used in making surveys and estimates for local road improvement under WPA. Obviously, methods will differ with the character of the work. Herewith are given data obtained by contacting various engineers in charge of, or having experience in, such work.

Essential Elements of a Complete Rural Highway Planning Survey

THE following outline of procedure suggested for making complete rural highway planning surveys has been prepared by Thomas H. MacDonald, Chief, Bureau of Public Roads, and furnished to the State highway departments.

1. *Road and Bridge Inventory.* From records and existing maps, supplemented as necessary by automobile speedometer surveys, determine the location in rural areas of all roads, sidewalks, railroads, railroad stations, aviation landing fields, navigable waterways, public piers and wharves, canals and canal ports, bridges and ferries (free and toll distinguished), grade separation structures, rural free delivery and star mail routes, public bus routes, school bus routes and common carrier truck routes.

Determine the type, surface thickness and width, and width of right-of-way, of all roads, and rate their condition.

Determine the radius of curvature and superelevation of all curves on all roads included in the existing Federal-aid and State highway systems and on the more heavily traveled of other roads. On the same roads determine all grades and the clear sight distance at all horizontal and vertical curves.

Determine the type, width, safe load and condition of all bridges.

Plot all the above data on large-scale maps; and group in classified statistical tables.

2. *Situs of Ownership of Motor Vehicles.* From registration and public service commission records, supplemented as necessary by other inquiries, determine the place and character of ownership of all motor vehicles; classifying motor trucks and busses by size and determining the character of business in which they are employed.

Plot situs of ownership on a map and group all data in classified statistical tables.

3. *Distribution of Rural Population, Churches, Schools, Etc.* From existing records, supplemented as necessary by other inquiries, determine the distribution in rural areas of population, dwellings, schools, churches, hotels, stadia, race tracks, and other places of congregation with respect to existing roads. For this purpose the post road maps of the Post Office Department will be helpful and the cooperation of rural mail carriers will be useful.

4. *Classification of Agricultural Lands.* Classify all rural lands as supermarginal, marginal, and submarginal in respect to their availability for agricultural production.

5. *Preliminary Traffic Count.* For the purpose of eliminating the least used mileage from further more detailed traffic studies, one day counts of traffic (passenger cars and trucks, separately) using all roads will be made at stations, shown on the maps to be prepared under 1 above, located at all intersections at which the data to be obtained by such one-day counts will be significant. Trucks should be clasified by rated capacity.

Using as a general criterion of minimum considerable importance, a minimum traffic density to be decided upon in each State or section of State of interest, all sections of roads shown by the one-day counts to serve less than such minimum daily traffic would be excluded from further more detailed traffic studies, subject to specific, previously defined exceptions, such as:

a) Where the section showing less than the prescribed minimum traffic is a short section of a through route the traffic on which is generally above the minimum.

b) Where for reasons other than normal density of traffic consideration of a road may be desirable, such as the presence on it of a school or church, or other similar objective of social importance.

6. *Detailed Traffic Surveys.* On all roads not excluded from further detailed study by means of the one-day counts and other considerations, make traffic surveys to reveal in detail the character, volume, origin, destination, fluctuation, and purpose of all traffic; such surveys to include at least the following elements:

1. Average daily density of passenger car, truck and bus traffic.

2. Maximum daily density of passengar car, truck and bus traffic.

3. Hourly, daily, and seasonal fluctuation of passenger car, truck and bus traffic.

4. Classification of truck and bus traffic by rated capacity of vehicles.

5. Wheel loads, gross loads and dimensions of trucks and busses related to rated capacity classification.

6. Origin and destination of traffic by locality.

7. Classification of traffic by type of origin and destination, such as:

a) farms
b) manufacturing plants
c) wholesale and jobbing establishments
d) retail establishments
e) railroad stations
f) wharves
g) airports
h) etc.

8. Character, volume and origin and destination of all commodities moved over the highways.
9. Daily train operation on all railways intersecting highways at grade.
10. Daily train operation and volume of freight and passenger movement on railroad branch lines.

7. *Volume of Industrial and Agricultural Production Moved by Highways.* Determine by location the volume and character of industrial and agricultural freight moving over the highways, the extent to which raw agricultural production is moved directly to its ultimate markets by highway, the relative volume of agricultural commodities received in cities by rail and highway, and other information needed to fill out the true picture of the freight service properly to be performed by the highways.

8. *Determination of Past Incidence and Amount of Highway Taxation and Necessary and Proper Changes in Existing Tax Policies.* From available records, determine the amount and source of all revenue available for road purposes and the purpose for which it has been collected and disbursed, the relative amounts of such revenue collected from urban and rural taxpayers, the relative burden of such payments in respect to the wealth, income, and road usage of the two groups.

Indicate inequalities of burden that require correction by revision of the system of taxation:

a) by shift from property to road-user taxes.
b) by revision of the schedule of motor vehicle taxes, based upon consideration of the relative road costs engendered by vehicles of various types, weights, etc.

9. *Objectives to be Reached.* Results of the several classes of study above outlined to be employed as required to accomplish the following ends:

1. Select and integrate highway system to include all roads to be improved in the next 20 years and indicate priority of improvement.
2. Record the present state of all parts of the selected mileage in respect to traffic serviceability, and indicate the amount, kind and cost of further improvement required to reach fully satisfactory serviceability.
3. Budget highway operations for a considerable future period, and indicate sources from which the necessary funds should be and can be obtained, properly related to benefits conferred.

Town Road Improvements for WPA Projects

By Olney Borden, Project Engineer, Sullivan Co. EWB

IN carrying out a program for town road improvement through the WPA, the roads should be selected by the town highway superintendents and approved by the county highway superintendent. The usual amount of information received through this method is, however, very small. The application merely locates the road, and gives the length, type of construction and width. More information is needed in order to prepare an estimate of the work that will be necessary.

The first step is an inspection of the road, and this should be done with the town superintendent. This insures getting the right road and the right section of that road. Also, from him can be obtained definite information regarding width, thickness of base, materials to be used, etc., and sometime it is possible to assist him in deciding to use a better type of surface, as tar or asphalt.

Measuring the length of the road with the speedometer, if this is used carefully, will generally give close enough results for this type of road, but this reading should be checked by making a return trip. In traveling over the road, the location, size and type of all culverts should be noted in a field or note book, and wherever new culverts are required, the location should be noted and clearly marked, with appropriate additional entries in the field book. Wherever cuts must be made that cannot be handled with a power grader, the amount of dirt to be moved may be estimated by pacing or measuring the length of the cut and the width and depth of the material to be moved at various points. Stakes may be carried in the car to indicate the limits of cut. Outcrops of rock or the presence of large boulders should be noted. Using the inadequate tools usually available to the WPA gang, such work runs up costs materially.

The sources of material for the stone base and for the gravel top should be investigated and the length of haul noted. New alignment requires more stone for base, and such sections should be carefully measured for this purpose and also because of the extra shoulder and ditch work usually needed.

Bridges on the route should be measured for width, span, size of opening, type of construction, condition, adequacy and condition and type of floor.

Notation should be made if the road is an RFD route, a school bus route, or carries other considerable traffic, since this information is important, in the application, as giving reason or necessity for the proposed improvement.

At the present time the WPA is approving such road projects as these with only a sketch of the road taken from a county or town map, which is nothing more than a location sketch. From unofficial sources the information has come that in the future, plans on a scale of 1 inch to 200 feet will be required. If this regulation is enforced, a survey will have to be run along the centerline of the road, either by stadia or by other means, elevations taken at all important changes of grade and sections on all banks which are to be cut. All the information mentioned in previous paragraphs could be gathered by the survey party.

Preparing the Estimate

The preparation of the project estimate from the field notes is a case of using the best figures available for each item of work. The following cost data are the result of some 18 months experience in this work:

Items	*Unit*	*Labor*	*Equip.*	*Mat'l.*	*Total Unit*
Rough-Grading	l.f. Road	.04	.02	—	.06
Excavation	c.y.	.75	.25	—	1.00
Hammer-Broken Stone-Base	c.y.	1.30	.40	.10	1.80
Stone-for-Fills	c.y.	.65	.25	.10	1.00
Ditchers and Shoulders	l.f. Road	.07	.03	—	.10
Rolling-Base and Top	l.f Road	.01	—	.04	.05
Gravel-for-Top	c.y.	.65	.25	.10	1.00
12" Cor. Iron-Sluices	l.f.	.75	—	1.00	1.75
18" Cor. Iron-Sluices	l.f.	1.25	—	1.50	2.75
Blasting-Large Rocks	c.y.	1.80	.70	.50	3.00
Common Labor	40c per hour				
1½ c.y. Trucks	.75	"	"	No-Driver	
10-Ton Roller	2.00	"	"	"	"
Power Grader	2.00	"	"	"	"
Air Compressor	1.00	"	"	"	"

To get the proper allocation between labor and equipment costs for the project, the estimate may be made up along the lines of the above table, varying the items according to the size of the project and any unusual conditions that may exist. Then a workable gang is determined, as 18 laborers, 2 truck drivers, 1 machine operator, 1 roller operator and 1 foreman, and the cost per day and per month for the gang determined. This is divided into the labor estimate for the project and

the result taken to the nearest half-month. On the basis of 7 to 10 men to a truck, the equipment item will usually work out quite closely.

In estimating labor requirements it should not be overlooked that WPA workers are paid by the month and allowance should be made for time lost due to weather, varied with the locality and the season.

Methods in Mississippi

By R. A. Harris, Chief Engineer

WE have not made any preliminary investigation of roads under the National Recovery Program other than a study relative to the respective merits of the road proposed and the area to be served by same. If it is deemed of sufficient importance to local communities by this Department to justify the construction of such roads we have proceeded immediately to make an actual survey of same, using as low a curvature as possible, a 26-foot crown, in most instances a gravel surfacing and a replacement of most of the minor drainage structures and a replacement of all bridges (over 20 feet) that would not be serviceable to care for traffic over the road. Therefore, we are not in position to state the facts to be noted in determining or examining such locations without making the instrument survey.

However, on State Work Order construction on some of the state secondary roads where we do not make field surveys covering the Work Order construction proper, we sometimes use speedometer readings and a protractor or compass in determining the present alignments, and in this way we are able to arrive at what should be done to improve the location. From past Work Order experience, considering the location of the project, we are able to arrive at a rough estimate of the approximate quantities that might be involved in the work to be done, and from a study of the drainage structures in place on the road, chiefly by investigation as to their present adequacy, we are able to determine whether the opening is sufficient. An examination of the structure itself will show, of course, whether it is in serviceable condition.

Relative to the decision as to improvement, the detailed procedure followed is along the lines used by and as established by general practice, in that center line is run, profile levels, cross sections, drainage areas, property lines and topography. This does not differ regardless of whether work is to be done force account or by contract, however, we have been able to proceed with the construction of force account projects in some instances before the plans were prepared. However, on work of this type we have generally started clearing and grubbing over the entire work after the alignment had been established and have worked up the plans in advance of the actual construction of the road itself.

Our state happens to be one of the few states in the United States that has what we deem an adequate system of secondary roads, and we are fortunate in that it is possible to travel over these roads the year round regardless of weather conditions. For this reason because of the establishment in the rules and regulations governing the expenditure of the Works Progress Administration funds with regard to the expenditure of certain percentages of these funds being made on secondary projects, we have not and cannot greatly benefit by the same, since the improvement generally is done on a road that is at present passable and fairly adequate to take care of traffic using the road.

Following is a digest of the important articles published last month having to do with water works design, construction and operation and water purification, arranged in easy reference form.

The Water Wheel

PURIFICATION in New England is found in 297 of the 726 public water supplies, but in 217 it consists of chlorination only. Slow filters are found in 34 plants, rapid sand in 38, and pressure filters in 8. While New England has insisted on sources of supply as clean as possible it "has been backward in its adoption of artificial purification processes which would have afforded additional factors of safety or which would have produced waters of superior physical quality." So far as typhoid mortality is concerned, New England has had an almost constantly better record than any other main subdivision of the United States.[F10-5]

Ortho-tolidine is, to date, the best reagent known for the determination of chlorine. However, accumulating difficulties with certain substances which interfere with the test throw some doubt on its reliability. The color indicative of chlorine is produced by either oxidation or diazotization; it is produced by nitrites in water and lignocellulose in wood, by manganese and iron. Therefore, the pressure of any of the interfering substances should be known and corrected for when testing a given water. The chief of these are manganese, nitrites and iron. The results do not seem to be affected greatly by less than 0.3 ppm of iron, 0.1 ppm of nitrites.[A8-8]

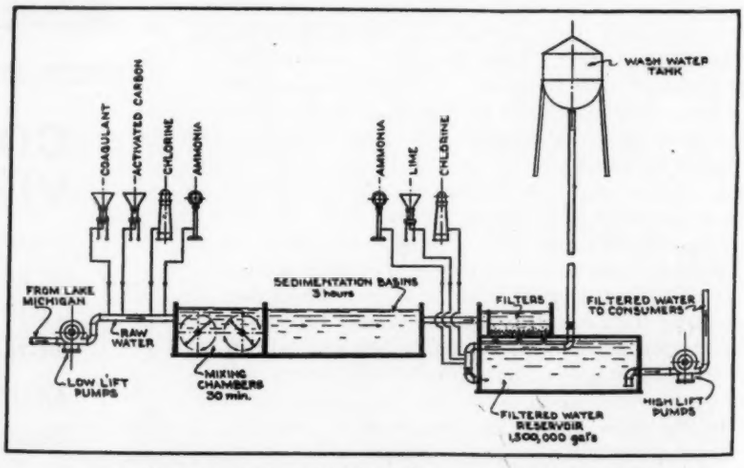
Diagrammatic illustrations of purification plants generally give a quicker idea of the main features of the plant than does a written description. Several methods of making these have been devised. Differing somewhat from the ordinary is one illustrating the plant fo Michigan City, Ind., designed by Greeley & Hansen There is one mixing chamber; a double sedimentation basin; 4 mechanical filters, each of 2 mgd.; wash water tank of 100,000 gal. capacity; 3 electrically driven low-lift pumps of 3, 5 and 8 mgd., respectively, the 5 mgd. having a stand-by gasoline engine; 2 electrically driven high-lift pumps of 3 and 2 mgd. which automatically keep the wash water tank filled. The coagulant (usually alum) is added continuously; activated carbon when required by tastes and odors; chlorine and ammonia when microscopic organisms are numerous and, after sedimentation, for final sterilization; and lime to adjust the pH.[F9-9]

Effect of age on pipe capacity has been studied by a committee of the New England Water Works Association, 473 tests having been made in 19 cities especially for this investigation. From a study of these and all other reliable records available they have reached certain definite conclusions. The average actual loss in capacity of tar-coated c-i. pipe after 30 years of service was found to be 52%; that of supply lines 16" and larger being 37%, and of distribution mains smaller than 16" being 64%. The rate of loss, however, varied in different cities, chiefly with the alkilinity and carbon-dioxide content of the water, and these were so related to the pH that this alone can be used in comparison of effects of different waters. The average capacity losses after 30 yrs. were found to be 30% for water with a pH of 8.0, 45% when pH was 7.0, and 85% when pH was 6.0.

Compared to the Williams-Hazen tables, these give considerably larger losses, except for large-diameter mains carrying relatively inactive water. With small mains carrying active water the loss may be 2 or more times those given by the tables. Also the losses during the first five or ten years is relatively greater than those shown by the tables. Considering the coefficient C in the Williams-Hazen formula, that for new tar-coated c.i. pipe is found to average 135 for transmission mains 16" and larger, and 125 for distribution mains with allowance for tees, valves, bends, etc.[B10-1, 2]

Cement-lined pipe capacity, using centrifugally lined pipe, is obtained by using a Williams-Hazen coefficient C of 134 based on diameter of unlined pipe, or 150 based on actual net diameter, as compared to 135 for new tar coated c.i. pipe. "Except in comparatively rare cases in which sponge growths develop in the pipe, a properly applied cement lining will maintain the hydraulic capacity of the pipe substantially at its initial value for a considerable period of service. Coefficients for c.i. pipe with natural cement lining not centrifugally applied average 136 for actual net diameter. An old-style cement pipe, wrought iron with cement lining and wrapping, 41 years old, had a C of 104.[B10-8]

Bitumastic enameled pipe, lining centrifugally applied, when new has a capacity approximately 15% in excess of that of new, unlined, tar-coated c.i. pipe, based on nominal diameters; C varying from 160 for



Diagramatic illustration of Michigan City, Ind., purification process

best conditions with large pipe, to 140 for worst conditions—small pipe with frequent branches, services, etc. As the first use of this pipe was in 1931, no data are available as to effect of age; but the same material applied by the hand brush method shows no apparent deterioration after 16 years of service.[B10-4]

Concrete pipe capacity has a wide range, depending on roughness of the surface and uniformity of bore. Large-diameter pipe manufactured by the best modern methods and workmanship has been found to have a Williams-Hazen coefficient of 152; while a pipe with rough joints made by a man new in business had a C of only 86. Probably 130 to 150 can be assigned to good modern pipe.[B10-10]

Lining pipe lines to restore and preserve carrying capacity is being done by four methods: Cement lining by the "Tate" process (mains up to 10″); cement lining by a centrifugal machine (mains 48″ or larger); electrically placed bitumen by the "Eric" process (mains up to 10″ and possibly 16″); and hot bitumastic enamel hand-brushed lining (mains 30″ and larger). The last, as applied by Newark, N. J., was described quite fully in *Public Works* for June, 1934. The "Eric" process was described briefly in the issue of August, 1934, p. 38. For lining by centrifugal machine, the pipe is first cleaned; then mortar of carefully selected proportions of sieved sand and cement is applied by equipment consisting of a motor-driven delivery dump truck which operates inside the pipe line and feeds a traveling hopper-type storage truck which in turn feeds, by means of a screw conveyor, a centrifugal machine. The last has two motors, one for traction at variable speed, the other at constant speed drives the screw conveyor, the mortar dispensing head and revolving trowels. The thickness of the lining applied is regulated by varying the traction speed from 1 to 4 ft. per minute. The dispensing head, revolving at 1,000 r.p.m., throws the mortar with great force against the pipe wall. This is followed by four steel trowels which revolve at 3 r.p.m, two clockwise and two counter-clockwise, which float-finish the lining. This was used on the Boonton line of Jersey City, N. J.

In the "Tate" process, the pipe is lined in sections about 200 ft. long, from which all service connection cocks were first removed and the holes plugged, and the pipe thoroughly cleaned with a rotary boring cleaner. Then more than enough 1:2 cement mortar to line the section is poured in at one end, the mortar having a 9 in. slump, and is pushed ahead and squeezed onto the pipe by means of a mandrel which is pulled through the pipe at the rate of about 20 ft. a minute. A stretch of pipe finished one day is put into service the next morning. The lining averages 5/16 to 3/8 in. thick. The cost in Manchester, England, was about 29 cts. per ft. paid by contract for the actual lining, and 43 cts. for excavating, cleaning, repaving, etc., done by the city employees.[A9-12, 13, 14]

B 10 — *Journal, New England Water Works Ass'n* — *September*

Pipe Line Friction Coefficients, Committee Rep't.

1. Summary of Report, pp. 239-248.
2. Coefficients of Tar-Coated Cast Iron Pipe, pp. 249-287.
3. Coefficient Values of Cement-Lined Pipe, pp. 288-294.
4. Coefficients of Pipe With Centrifugally Applied Bitumastic Enamel Lining, pp. 295-298.
5. Coefficients for Miscellaneous Types of Lining, p. 299.
6. Lining Small Mains in Place With Cement, pp. 300-302.
7. Corrective Water Treatment for Reduction of Corrosion, pp. 303-305.
8. Restoration of Capacity of Unlined Cast-Iron Mains by Cleaning, pp. 306-313.
9. Coefficient Values of Steel Pipe, pp. 314-321.
10. Coefficient Values of Concrete Pipe, pp. 322-330.
11. Various Tests Affording a Direct Comparison of Coefficient Values for Different Types of Pipe, pp. 331-334.
12. Effect of Velocity on Values of Williams-Hazen Coefficient, pp. 335-337.

D 10 — *The Surveyor* — *September 6*

1. *p*, Rural Water Supplies. By C. A. Wilson, pp. 251-252.

E 10 — *Engineering News-Record* — *September 5*

1. Safety Feature in Earth Dam Spillway. By W. V. R. Fretts, p. 319.
2. *c*, Eroded Limestone Complicates Corewall Job. By F. Gannett, pp. 328-330.

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3. Hartford Enlarges Its Water Supply System. By C. M. Saville, pp. 351-356.
4. *n*, Friction Tests in New Cast Iron Centrifugally Formed Pipe, p. 357.
5. Denver Goes to West Slope for Additional Water Supply, pp. 357-358.
6. Groundwater Relieves Drought Emergency. By G. H. Taylor and R. M. Leggette, pp. 359-361.
7. Aberdeen, S. D., Abandons Wells for Treated Surface Supply. By W. W. Matthews, pp. 361-365.
8. Improved Management Aids Waterworks Development. By P. C. Gale, pp. 365-367.
9. Stub Plan Simplifies Water Consumer Accounting. By M. F. Hoffman, pp. 368-369.
10. Water Plant Capacity Increased by Modifying Settling Unit. By R. F. Goudey, pp. 370-371.
11. Filters and Meters for Chicago Move Toward Reality. By A. E. Gorman, pp. 371-374.
12. Evaluating Pump Efficiency as a Basis for Better Purchase Specifications. By H. J. Summers, pp. 375-376.

September 19

13. *n*, Steel Cylinder Concrete Pipe Cast in Long Sections, p. 405.

F 10 — *Water Works Engineering* — *September 4*

1. Increasing the Efficiency of Small Water Plant. By W. S. Staub, pp. 982-983.
2. Effects of Passing River Water Through Chain of Lakes. By R. A. Thuma, pp. 987-989.
3. *p*, How the Water Works Dept. Can Be Made a Paying Institution. By H. H. McGuire, p. 1000.

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4. French Artistry Exhibited in Paris Well Supply. By R. S. Charles, pp. 1052-1055.
5. Water Purification in New England. By E. S. Chase, pp. 1056-1058.
6. Watershed Improvements with Federal Funds. By R. W. Esty, pp. 1059-1061.
7. *p*, Results of Chloramine Treatment in Duluth, Minn., Water Supply. By D. L. Johnson, pp. 1061, 1096.
8. Quabbin Reservoir Work Now in Full Swing. By K. R. Kennison, pp. 1062-1064.
9. What Type of Curb Stop Is Favored for Water Works Use? By H. Rupard, pp. 1064-1065, 1096.
10. Use of Sources of Water Supply for Recreational Purposes. By A. D. Weston, pp. 1070-1071.
11. Surface Supply Gives Aberdeen Softer Water. By B. Rowlee, pp. 1072, 1074, 1077.
12. *p*. Selecting the Source of Supply. By M. Z. Bair, pp. 1078, 1080, 1096.
13. 3,500-Year-Old Water Tunnel Unearthed in Palestine. By H. H. Slawson, p. 1099.

G 10 — *Water Works and Sewerage* — *September*

1. Water Works of Lancaster, Pa., on Its One Hundredth Birthday. By J. J. Malone, pp. 297-302.
2. Spartanburg, S. C., 1,500,000 Gallon Elevated Tank. By R. B. Simms and J. K. Marquis, pp. 303-304.
3. Anthrafilt Gives Longer Filter Runs Than Sand. By H. G. Turner and G. S. Scott, pp. 308-310.
4. New Sulphur Jointing Compound for Bell and Spigot Pipe. By C. R. Payne, pp. 317-318.
5. *n*, Water Requirements of Apartment Houses, p. 318.
6. Filtering Materials for Rapid Sand Filters; Mud Balls. By J. R. Baylis, pp. 326-330.

J 10 — *American City* — *September*

1. Water Works Construction With ERA Labor. By F. A. Marston, pp. 42-43.
2. Gloversville Water Supply Saved by an Economical Plan. By M. Vrooman, pp. 47-48.
3. *n*, Unusual Water Tower Cuts Insurance Rate for Waukesha Business District. By A. P. Kuranz, pp. 55-56.
4. Hyde Park, N. Y., Improves Its Water Supply. By J. C. Harding, pp. 71-72.
5. Remedies for Water Larceny. By A. L. H. Street, pp. 75-77.
6. Water Rates and Service Charges, pp. 95, 97, 99, 101, 103.

L 10 — *Civil Engineering* — *September*

1. *c*, Construction of Morris Dam. By V. L. Peugh, pp. 549-552.
2. Large Concrete Pressure Pipes. By N. D. Whitman, pp. 553-555.
3. Selecting Materials for Rolled-Fill Dams. By C. H. Lee, pp. 556-557.
4. Chlorinating Method Improved at Los Angeles By R. L. Derby, pp. 558-561.
5. Water Conduit Construction in the West. By F. C. Scobey, pp. 569-571.

M 10 — *Canadian Engineer* — *September 17*

1. *c*, Pumping Station for New Duplicate Water Works System. Toronto, pp. 7-10.
2. *p*, The Mineral Water Supplies of Ontario. By Prof. E. G. R. Ardagh, pp. 13-14.

P 10 — *Public Works* — *September*

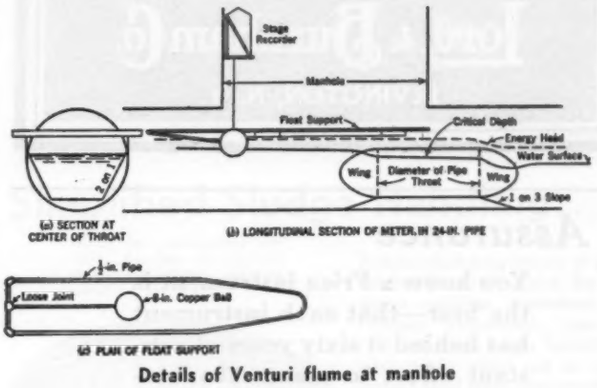
1. Interesting Features of An Everglades Water Works Plant. By J. W. Swaren, pp. 9-11.
2. Probable Flood Flow From a Small Watershed, p. 12.
3. *n*, Aeration of Water by Air Diffusion. By F. C. Roe, p. 16.
4. Measuring Rainfall, Runoff, Stream and Storm Water Flow, pp. 20-21.
5. An Eight-Billion-Gallon Water Clarification Plant, p. 30.
6. *n*, Automatic Reduction of Pipe Corrosion, p. 30.

A Digest of the Sewerage Literature of the Month giving the main features of all the important articles published.

The Digestion Tank

VENTURI flumes have advantages over weirs for measuring flow in sewers and other conduits. The empirical weir formula is accurate only when certain fundamental conditions are obtained exactly, which they rarely can be in a confined channel. A venturi flume is described as "any stream-lined device placed in an open channel, or a closed channel partly full, having a sufficient constriction to cause water to flow at a critical depth with parallel filaments." Such a meter gives minimum head loss, preventing deposits of sludge above it; has no sharp edges to catch rags and other floating refuse; can measure the entire designed flow and yet is sensitive enough to record low flows; is adaptable to the use of a simple float mechanism for recording water stage, and can readily be installed with minimum interference with sewage flow.

The correct size and shape of throat for use in a given conduit is that one for which the energy head is greater than the normal energy head in the free flowing conduit at all volumes of flow, and with a bottom slab thin enough to prevent deposition of sludge at low flow. With such a throat a drop in the energy occurs just below the throat, indicated by a jump in the water surface at this point. The throat must have sufficient length to secure flow in parallel filaments at the point of critical depth—a length at least as great as the diameter of the pipe. It may be either rectangular or trapezoidal in shape.[K10-1]



Details of Venturi flume at manhole

Stage digestion at Newark, N. Y., with a turbo-mixer in the primary tank keeping a uniform solids content throughout the tank, gave about 50% more gas formation than when the tanks were operated parallel. The reduction in volatile matter was 42.6% in the first stage and 55.5 for both stages, while the overflow liquor contained only 0.27% total solids. When the tanks were operated parallel, the overflow liquor total solids exceeded 2.0% and when returned to the raw sewage caused septic action in the primary clarifier. In both cases the average temperature in the digesters was maintained at 80°.[G10-2]

Spray drying of sludge at the Plainfield, N. J., plant, after a year's operation has been proven feasible beyond a doubt. Sludge so dried should contain more than 5% solids, but if containing more than 12% can not be pumped without difficulty. This can be dried to any degree desired. With 60% solids, sludge handles well but cannot be stored successfully. With 70% it still is easily handled and can be stored. With more than 70% the sludge is rather dusty to handle. Basing a calculation on the drying of sludge from 5% solids to 70% solids, there is required for drying sludge containing one ton of dry solids: 2,984 lbs. of coal, 95 kwh. of power, 4.3 hours of labor and 80 lbs. of alum. (The alum is used to concentrate 5% sludge to 10% by flotation.) Under Plainfield conditions this gives a cost of $12.04. This cost can be reduced to $9.86 if the alum be allowed to operate for a longer period and reduce the sludge to 12% solids. There is no trouble in getting $10.00 a ton for the 70% sludge "as is." The cost figures contain nothing for maintenance and repairs, as there are no data on which to base these. Digested sludge so dried gives off no odors, but raw sludge does.[G10-3]

Ferric chloride used at the York, Neb., treatment works at the rate of 82 lbs. per million gallons for several months past is produced by passing chlorine solution from a chlorinator over crushed tin cans in reaction tanks formed of vitrified sewer pipe set in concrete. "A reasonable amount of supervision over the strength of the chlorine solution is necessary to insure the formation of *ferric* rather than *ferrous* chloride but, at this plant at least, it seems that as long as approximately 40 gallons of water are used per pound of chlorine, and if the reaction tanks are kept reasonably full of crushed cans, practically all of the chloride produced is in the ferric form." With chlorine at 10 cts. a pound, the ferric chloride costs approximately 5 cts. a pound exclusive of the labor for collecting and crushing the tin cans.[G10-1]

Sludge fertilizer is made at the Pasadena (Calif.) sewage disposal plant at the rate of 3,034 tons a year—53 lb. per year per unit of population served. Excess activated sludge is drawn from re-aeration tanks into two dosing tanks, where 3½ to 7 lbs. of ferric chloride are added per thousand gallons, and thoroughly mixed by aeration. The coagulated sludge, 99% moisture, is reduced to 80% by three vacuum filters; and the filter cake is dried to 5% moisture in revolving, cylindrical, double-shell dryers, using natural gas as fuel. The dried fertilizer is screened, ground, screened again, and packed in burlap sacks containing 100 lb. net. The fertilizer "supplies a good, slow-acting form of nitrogen, which continues to be available long after the other forms of nitrogen have been exhausted." It is sold through certain contract distributors who sign yearly agreements to take certain minimum tonnage per year and sell at prices set by the city, receiving sufficient discount from this to pay salesmen's commissions and give a profit. This disposal, as compared to the previous practice of filtering and burying in ditches, gives a net saving of $22,000 to $40,000 per annum.[L10-1]

Ferric hydroxide for precipitating sewage can be made by passing carbon dioxide through sewage in the presence of metallic iron, thus forming soluble iron bicarbonate; then by vigorously aerating the sewage, the excess carbon dioxide is driven off and the iron bicarbonate is oxidized and precipitated as ferric hydroxide. Waste gases, such as stack gas or exhaust from a gas machine, with a carbon dioxide content of 10 to 15% may be used as a source of carbon dioxide, and iron borings are a cheap supply of iron. The operating costs of this process are in this way reduced to a very low figure. Treatment of the sewage can be completed in about 30 to 40 minutes and the purification obtained is equally as good as by precipitation with ferric salts.[C9-19]

Deodorizing gases created by sludge drying at Pasadena has been the subject of several experiments. Passing through water sprays, through charcoal and chlorinating, had little effect. Oxidation with ozone had only a little effect, with high cost. Test showed that a temperature of 1000° F. completely eliminated odors. This plan was adopted, using a horizontal gas incinerator furnace. This was successful, although expensive, except for difficulty with sludge dust which caused occasional minor explosions. Then a vertical furnace was built, giving some advantages, although the cost for fuel was $7,200 a year, while that for sludge drying was $7,360. In June, 1935, two spray towers were put in operation, removing 90% of the dust from the gases. It is now proposed to build a heat exchange apparatus consisting of 2 cylindrical shells 17 ft. diameter, lined with 4½ in. of insulating bricks and 4½ in. of refractory material, with water-seal reversing valves for directing the flow of gases back and forth through the fuel beds to the atmosphere. Each "stove" will contain 90 tons of rock to be heated to 1600°, the gas passing through this in a heated stove and then through the rock in an unheated one, to which it yields much of its heat. These are expected to be in operation this fall, and to deodorize thoroughly at a fuel cost of 15% or less of that required by the present furnace.[L10-2]

Garbage in sewage, if all the garbage of a city be placed in the sewers, would double the total solids and the volatile solids, increase the B O D about 25%, and more than double the grease, while the digestibility of the solids (at least in an Imhoff tank) is much less than of sewage. In a test at the University of Illinois, the gas collectors clogged quickly with a greasy scum, accumulated gas wrecked the baffles, and after 7 months of operation there was no sludge; the liquor was milky white, highly acid and extremely offensive in odor; the top of the digestion compartment and the gas domes were clogged with 6 to 10 ft. of scum, the odor of which was very offensive.[C9-7]

Grease in sewage amounted to a maximum of 5,160 ppm. in the Salem-Peabody (Mass.) sewage, due chiefly to wastes from sheepskin tanneries. Grease balls form in the sewers, around matches or other nuclei, and float more than 60 miles from the outlet in sea water. They contain free fats varying from 25 to 45%, dry basis, and 30 to 47% soap fats.[C9-8]

Imhoff tank forms used in constructing ten tanks for the Rochester, N. Y., sewage works were all lined with ¾ inch 5-ply wood and had 3x4 inch studs 24 inches on centers with double 2x6 wales on 4-foot centers. The plywood forms were used ten times, being oiled before

usage and cleaned after each stripping. The concrete for the hopper bottoms was made no-slump, 14 gal. of water being used for a batch of 6 bags of cement, 1,320 lb, of sand and 1,860 lb. of stone. In the wall 2-inch slump concrete was used, with 24 gal. of water to a batch. The walls were poured in 4-ft. lifts. For handling bags of cement to the mixer, the contractor used a roller conveyor, placing a piece of plywood under each pile of three bags, as the bags alone would not roll on the conveyor.[B9-1]

Bibliography of Recent Sewerage Literature

To find an indicated reference, find the given letter and bold-face number at the left of the column, and the light-face number (following the dash) immediately below this. The bold-face number indicates the month of issue of Public Works in which the article was listed, which is generally the current but may be a previous one.

c, Indicates construction article; *n*, note or short article; *t*, technical article.

D 10 — *The Surveyor* — *September 13*
1. Use of Chlorine in the Activated Sludge Process. By H. C. H. Shenton, p. 279.

G 10 — *Water Works and Sewerage* — *September*
1. Sewage Treatment Works of York, Neb. By F. M. Veatch, p. 305.
2. Operating Experiences at Newark, N. Y. Sewage Treatment Plant. By T. J. Smith, pp. 319-322.
3. Spray Drying of Sludge. By J. R. Downes, pp. 323-325.
4. Tannery Waste Disposal at Rockford, Mich. By G. E. Hubbell, pp. 331-332.

H 10 — *Municipal Sanitation* — *September*
1. Indianapolis Operation and Research Problems. By C. K. Calvert, pp. 262-266, 273.
2. Sewer Construction and Purchase Contracts. By Leo T. Parker, pp. 271-273.
3. Landscaping Sewage Treatment Plants, pp. 274-275.

K 10 — *Proceedings, American Soc. of Civil Engineers* — *September*
1. Adaptation of Venturi Flumes to Flow Measurements in Conduits By H. K. Palmer and F. D. Bowlus, pp. 962-982.

L 10 — *Civil Engineering* — *September*
1. Sludge Disposal at Pasadena. By H. W. Hincks, pp. 561-564.
2. Odor-Control Experiments at Pasadena. By O. H. Hedrich, pp. 564-566.

P 10 — *Public Works* — *September*
1. Use of Anthracite in Sewage Sludge Beds. By R. R. Cleland and G. S. Scott, pp. 13-14
2. Chemical-Mechanical Treatment of Sewage. By P. B. Streander and M. J. Blew, pp. 22-24.
3. Sewage Treatment for a Small Village. By G. L. Robinson, pp. 27-28.
4. Laying a Thousand-Foot Sewage Sea Outfall, p. 28.

T 10 — *Technique Sanitaire et Municipale* — *August*
1. Les Canalisations pour l'Evacuation des Eaux Usees, pp. 177-178.

Operating Schedule for Activated Sludge Plant

A TIME schedule for the operation of the activated sludge plant of Woodstock, Ill., was adopted by Ray H. Corr, operator of that plant, when he took charge of it. This schedule is offered by the Division of Sanitary Engineering of the Illinois Department of Public Health, with the recommendation that all plant operators, using this as a suggestion, prepare one to fit their own plant. "While it will be necessary to make deviations at times because of emergencies, following it as consistently as possible will permit you to get all your work done in the proper order."

Mr. Corr's operating schedule is as follows:

7:00 A.M.—Inspect all motors and machinery.
7:15 A.M.—Rake bar screens and bury screenings.
7:30 A.M.—Start primary tank sludge collectors.
7:45 A.M.—Read meters and record temperatures.
8:00 A.M.—Begin pumping primary sludge to digester.
(I find it necessary to remain near sludge pump in order to check the character of the pumpage. During this 30 minutes to one hour period, I sweep the building and check the drip pot and water seal on the gas line).
9:00 A.M.—Start making out report, clean glassware for tests, hose down decks and general clean-up.

10:00 A.M.—Take sludge temperature. Adjust secondary tank sludge line valves for equal sludge return from both units. This is necessary because of the common suction from both tanks.

11:00 A.M.—Collect samples and make dissolved oxygen tests. Set up Imhoff cones.

12:00 Noon—Check meters and clean bar screens before eating lunch.

1:00 P.M.—Clean aerator blades. Work on grounds, cutting grass, etc.

2.00 P.M.—B.O.D. determinations.

3:00 P.M.—Pump primary sludge to digester.

4:00—P.M.—Suspended solids determinations.

4:40—P.M.—Check motors and clean bar screens.

Then, of course, the following duties must be worked in:

Oil all machinery once weekly.
Draw supernatant liquor from digester.
Clean grit chambers.
Hose down flow channels through plant.
Keep ice off aerators and out of gas lines.
Take up bearings, pack stuffing boxes and general equipment maintenance.
Keeping records and reports.

I spend on an average of 3 hours a day in the laboratory and office, as I figure this is the place from which to operate the plant.

This suggestion by the Department of Public Health is contained in a quarterly bulletin which it issues with the title "The Digester," the object being "to promote the installation and efficient, economical operation of sewerage systems." The idea is certainly an excellent one, and we hope the aim will be achieved.

Keeping Filter Sand in Good Condition

At the Indianapolis Water Plant, Jordan and Kershaw remove the sand from each filter by means of a Nichols ejector about once each year. The sand is removed from No. 1 filter and allowed to remain undisturbed until all of the filters have been washed; that is to say, sand from No. 2 filter is ejected back into No. 1, sand from No. 3 back into No. 2, and so forth right on down the line and finally the sand removed from No. 1 is placed back in the last filter. It has been found that by ejecting the sand from one filter to the other periodically they have been able to operate on a small amount of wash water, averaging 1.71%. The sand is ejected under 110 lbs. pressure, using the separator portion of a Nichols sand washer. This treatment minimizes cracks and mud balls and is especially advantageous in plants where you are not able to use high rates of wash.

At Detroit, Wallace and Hulbert use a high pressure nozzle wash. A 1½-inch hose with a ½-inch nozzle operating under 70 lbs. pressure is held 12 inches above the top of a drained filter bed. The waste valve is left open. If puddles appear in the sand, it indicates that the sand is very dirty. They wash the filter twice in this manner going over every inch of it. Between the "nozzle washing" the filter is backwashed. Their sand is in very good condition and this method of wash seems to be very effective.

At Atlanta, Ga., Weir uses a concentrated solution of chlorine water, filling the filter up with chlorine applied from a diffuser to the forebay of the filter, and drawing this concentrated chlorine solution down into the filter sand. This is another excellent method of keeping filter sand in good condition.

At the Daytona Beach, Fla., water softening plant, it used to be common practice to apply chlorine to pressure filters once every 90 days. This was done by placing a drum of chlorine directly connected to the wash water

line by removing the loss of head pressure gauge. The chlorine was applied while the filter was being washed, so that the concentrated chlorine water would have a chance to penetrate the filter sand while the sand was in suspension. It was easily determined when sufficient chlorine had been applied to the filter, because it was necessary to shut off chlorine and leave the room when the chlorine came through on the wash water. The wash water should be shut off at the same time and the filter allowed to remain overnight. This treatment keeps the sand in good condition especially in view of the fact that the filter was operating on softened water. It had a tendency to clean the sand grains in much the same way as Enslow explains that chlorine water from a chlorinator can be used to advantage to clean lime solution lines. In most pressure filter installations, whether softening plants or alum coagulation plants, it would be a good idea to give them a shot of chlorine occasionally, applied while they are being washed, and allow this concentrated chlorine water to remain in the filters a few hours. You would be surprised how much better tasting water will come from this same unit after cleaning with chlorine water.—*F. E. Stuart in paper before Southeastern Section, A. W. W. A.*

Activated Sludge Treatment at the Davyhulme Plant, Manchester

A new activated sludge plant was inaugurated at the Davyhulme sewage works of the Manchester (England) Corporation in May, 1935. These works have to deal with the sewage from a population of 775,000 people with a dry-weather flow of 32,000,000 gpd. In enlarging them, the existing primary and secondary contact beds were retained, to be operated up to their determined effective capacity of rather less than half the dry-weather flow; and an activated sludge plant added to deal with the remainder. At the same time, provision was made for removing the detritus and screenings from all the sewage. Of the 16 existing settling tanks, 8 are now used for storm water, 5 for sewage to be dealt with by contact beds and 3 for that to be treated in the activated sludge plant.

The main activated sludge plant is designed to treat a dry-weather flow of 16,000,000 gpd. on the diffused air system and 1,000,000 in a "Simplex" plant, and 600,000 is treated in a bio-aeration unit; the last two with a view of gaining information which may be useful for future extensions. Air is supplied by three turbo-blowers, which developed an overall efficiency of 62 to 67%, depending on volume and pressure of air. One of these furnishes 18,000 cu. ft. of air per minute, the other two each furnish 12,000 cu. ft.; working air pressures vary from 7 to 8.3 lb. per sq. in.

The surplus sludge from all the plants can be passed into a circular tank of 200,000 gal. capacity fitted with a Dorr thickener, which can be operated on either the fill-and-draw or continuous flow system. The sludge from this tank is pumped either to the inlet of the primary settling tanks, or to storage tanks from which it is pumped 2½ miles through a sludge main for disposal on land.

There were, as is generally the case, minor difficulties in starting the plant in regular, continuous operation, and it was several months before the plant settled down to operation from which the regular operating efficiency of its several parts can be judged. Such figures will probably be available early in 1936.

St. Paul Water Works Notes

Relief labor was used by the St. Paul, Minnesota, water department during 1934, the amount used during this year and 1933 having amounted to approximately $250,000. This labor built a canal between Sucker and Vadnais lakes, painted more than 5,000 fire hydrants and all pumping stations and engineers' dwellings and made many repairs to property and structures.

Improvements made in office methods, including new accounting machines, reduced the help of the department by one-sixth, "thus releasing clerical help to other needs."

The receding water of the lakes, decreased flow of the rivers and violent dust storms, all due to the prolonged drought, changed the entire character of the surface water, except that "the bacteriological data show that the actual contamination of the water was not far different from that of the preceding years." One change was in the increased number of crustaceans, which caused considerable annoyance and additional expense in plant operation. They are of such size and activity that it is practically impossible to precipitate them out in the coagulation basin, but they pass on to the filters and collect there, clogging the surface and necessitating backwashing at frequent intervals.

Rock-paved Sucker-Vadnais Lake canal constructed under CWA and ERA.

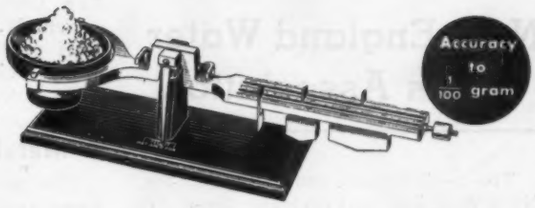
The above items are from the annual report of the Board of Water Commissioners, Leonard N. Thompson, general superintendent and engineer.

Thermophilic Digestion of Activated Sludge

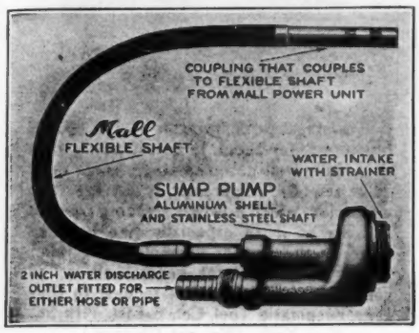
In a discussion on thermophilic digestion of activated sludge, held at a conference of the (English) Institute of Sewage Purification in August, it was stated that experiments with such digestion at Halifax "yielded a sludge which, far from being improved, was much worse than the original product." In laboratory experiments at Sheffield, "the final product was very definitely foul —there was no question whatever about it." Dr. Ardern expressed the surmise that the results at these places had been due to the type of seeding. At Davyhulme there had been no such objectionable result, but the thermophilic sludge "could be dealt with on drainage areas without the production of flies, and the only odor was slightly ammoniacal in character—certainly not at all foul." However, the separated water from such digestion was very much more polluted than that from digestion at a lower temperature.

When you need special information—consult the *classified* READERS' SERVICE DEPT., pages 51-53

What's New?



This Bennett balance weighs up to 100 grams and has a sensitivity of 1/100 gram. No loose weights; you can carry it in a pocket, if you want to; it is only a foot long and weighs less than a pound. You'll be surprised at the price. Write Chemical Publishing Co., 175 Fifth Ave., N. Y.



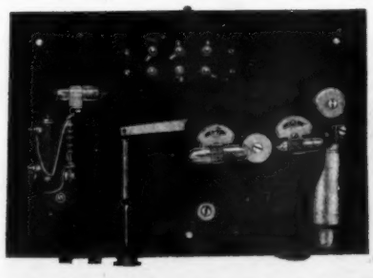
Mall Sump Pump

A New-Type, Light Weight, Large Capacity Sump Pump

The Mall Tool Co., Chicago, Illinois, has introduced an entirely new type of sump pump. This is constructed of non-corrosive materials. It requires no air compressor or other expensive auxiliary equipment to operate. It is very light in weight, portable and easily carried by one man. Ideal for pumping out excavations, sumps, caissons, tunnels, trenches, manholes, tanks and coffers and will pump clear or muddy water, sewage or oil with equal efficiency.

It is self-priming because the pump itself is submerged directly into the water being pumped. It is non-clogging and discharges 4500 gallons per hour against a 25 ft. head. The 2″ discharge opening can be fitted with either hose or pipe.

It can be operated from any Mall gasoline engine or electric set with vibrator shaft detail by simply coupling flexible shaft furnished with pump to flexible shaft used for vibrating. The pump unit includes 3′ 6″ of flexible shaft and housing. The complete assembly weighs 27 pounds.



Here is something new and worth while for the man with water storage problems on his hands. This is a single pump control for elevated tank systems. It is not affected by starting or stopping surges. Requires no auxiliary devices. Totally enclosed; easy to set. Write Water Level Controls Co., 765 Hampden Ave., St. Paul, Minn.

New Garbage Truck Bodies for Cleveland

A fleet of twenty-five new garbage collection units was recently put into service by the City of Cleveland Department of Public Service. The bodies were built by Gar Wood Industries, Inc., Detroit, and installed on Truck Engineering semi-trailer chasses. The tractors are all Chevrolet 1½ ton 157″ w. b. with a sleeper cab in which shelves are installed, replacing the usual berth. This provides space to carry the pick up cans and gives room for four men all inside.

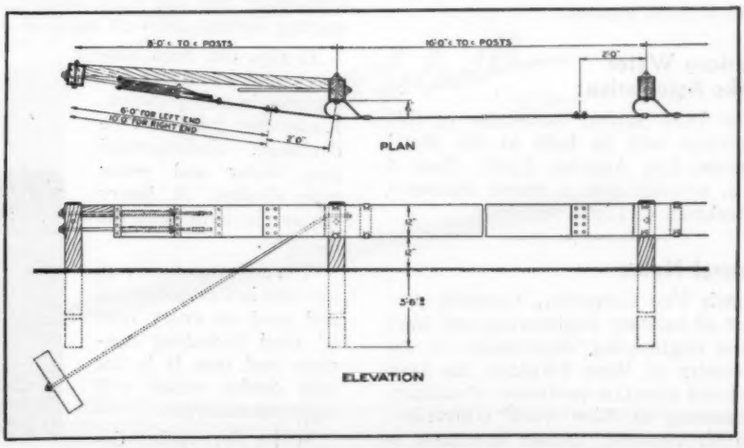
Capacity of each is 9 cu. yds. with 3 cu. yds. hinged extension sides, making 12 cu. yds. total capacity. Bodies 16′ long, 7′ wide, constructed watertight of 10 gauge steel, with double acting watertight tailgate. Wheel housings are provided, thus permitting low mounting. A rack is installed on the front of the body to accommodate tarpaulin when body is being loaded.

The new Garbage Collection Unit for Cleveland, O.

"Kalguard" for Traffic Protection

"Kalguard" highway guard rail has been developed and placed on the market by the Kalman Steel Corporation, subsidiary of Bethlehem Steel Corporation, Bethlehem, Pa. It consists of strips of semi-spring steel joined together to form a continuous guard rail that is attached to the posts by means of shock absorbing brackets and held in proper alignment through helical-spring assemblies at the end posts.

It is made in standard assemblies, end, bracket, and intermediate sections to facilitate ordering and installation. The intermediate sections of the rail are furnished in standard widths of 12 in. and standard lengths of 16 ft., in any gauge specified. However, to meet unusual conditions it may be readily obtained in other sizes. For convenient installation on existing bridges "Kalguard" can be furnished in 18-in. widths.



Kalguard Highway Guard Rail.

New England Water Works Association

The 54th annual convention of the NEWWA, held at Providence Sept. 17 to 20, was quite the finest event this reporter has seen for a long time. Attendance was good, the papers presented at the technical sessions were of the usual standard, the entertainment and fellowship at the meetings were unusual.

Another item in the round of pleasurable events was the presentation to Frank E. Winsor, chief engineer of the Metropolitan District Water Supply Commission, Boston, and to Stephen H. Taylor, superintendent of Water Works, New Bedford, Mass., of honorary memberships in the association. To Karl R. Kannison, assistant chief to Mr. Winsor, went the Dexter Brackett Memorial Medal.

It was probably the events of the smoker on Tuesday evening that started off the convention on its very best foot. Under the able direction of William J. Orchard, chairman of the entertainment committee, a program was put on that held the entire audience for nearly three hours. The entertainment was entirely by waterworks talent, and in the opinion of this reporter who is no great shakes at judging such events, however, it was far superior to anything he has ever seen from paid performers at any convention meeting. A group composed of J. Wafer, Clinton Inglee, George Norcom, J. Butler, E. J. Reilly, George Hagetter, and Rudy Lowe, assisted by Mrs. Lowe and Miss Alma Reichl, and directed by Mr. Orchard, provided the entertainment.

Other enjoyable features included the trip to the Scituate Reservoir of the Providence water works, the boat trip on Narragansett Bay, and the annual dinner. The water works entertainers again performed to the entire satisfaction of all, at and following the dinner.

We might hazard a guess that if the entertainment features at other conventions and technical meetings were so excellent, and so well woven into the spirit of the entire program, the attendance would be even greater.

American Water Works Association:

The 1936 annual convention of this association will be held at the Hotel Biltmore, Los Angeles, Calif., June 8 to 12, according to a recent statement by Beekman C. Little, secretary.

Personal Notes:

Lewis Van Carpenter, formerly professor of sanitary engineering and head of the engineering department of the University of West Virginia, has been appointed associate professor of sanitary engineering at New York University. John K. Vennard, former instructor in hydraulics at Massachusetts Institute of Technology, has also been added to the New York University staff.

Seth M. Van Loan, formerly deputy chief of the Bureau of Water of the city of Philadelphia, has been appointed chief of that Bureau.

A Metal Protection Paint:

The protection of ferrous-metal surfaces against the destructive action of oxidization through the use of the oxide coating itself is a new and important development in the paint field. Instead of requiring hours of labor for its removal, the rusted surface becomes an essential part of the protective coating, forming a light-proof color body that is unusually resistant to the action of acids, alkalies and the destructive forces of nature.

The paint is doubly positive in its protective qualities and forms a non-inflammable and very tough film with great adhesive powers. In fact, it is claimed, no other film is equal in resistance to acids, alkalies and other corrosive and destructive elements to paints.

Full data from Harrington Paint Co., 1630 Collamer Ave., Cleveland, O.

The New Carter Sludge Pump:

It is stated that these pumps are self-priming to the limit of suction and will pump with efficiency and economy anything that can flow to the pump cylinder. Of rugged construction, the stroke is adjustable from zero to maximum, allowing a wide range of capacity. Drive is by V-belt or enclosed chain. Made in sizes from 4900 gallons maximum capacity per hour to 212,000 gallons, in simplex, duplex and triplex. Booklet is available to engineers giving complete data. Write Ralph B. Carter, 192 Atlantic St., Hackensack, N. J.

The editor of these columns saw one of the sludge pumps installed in the new sewage treatment plant at Woodridge, N. Y., planned by A. S. Okun.

A Combination Excavator and Ripper:

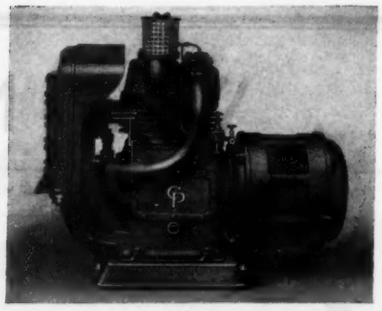
It is claimed by Contractors Machinery Corporation, Batavia, N. Y., the manufacturers, that this new piece of equipment does the work heretofore requiring several different machines.

It rips old road surfaces and excavates the material in one operation. Excavates road side drainage, underground gas, water and sewer pipe ditches. A heavy Ripper is built into the machine.

The manufacturers say that it was developed and used on every type of road including concrete and that it is the only device which will undercut concrete.

Write for folder describing this equipment.

This lowers highway construction costs



A two-stage air compressor at 100 pounds pressure takes about 15% less power than an equally well designed single stage unit. This new CP compressor is 2-stage, also air-cooled, which prevents freezing troubles and makes it an especially fine unit for some of this winter unemployment relief work, as well as for general all-around construction. Full dope on request to Chicago Pneumatic Tool Co., 6 East 44th St., New York. (No, not Chicago.)

A Rubber Lined Pump for Handling Chemicals:

The particular application of this pump, which is made by the Quimby Pump Co., 340 Thomas St., Newark, N. J., is in the handling of ferric chloride solution. The rubber lining, resistant to the corrosive action of the ferric chloride solution, is resilient, and can expand and contract without danger of cracking when changes of temperature take place. This rubber is applied by a process which vulcanizes the rubber directly to the metal casing and the impeller. These "DB" Quimby-Doty type pumps are made in capacities up to 700 gallons per minute. Of course, other chemicals than ferric chloride can also be handled.

New White Trucks Are Streamlined:

A complete new series of motor trucks have been announced by the White Motor Co., Cleveland, O. These range in size from 1 to 4 tons in capacity. They are completely streamlined, and are said to be the first trucks to be so designed. Despite the many new features that have been added, these new trucks sell at low figures. The streamlined chassis can be obtained with standard bodies, as desired, and also with tractor-trailer units.